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FIRST VISCOUNT COWDRAY

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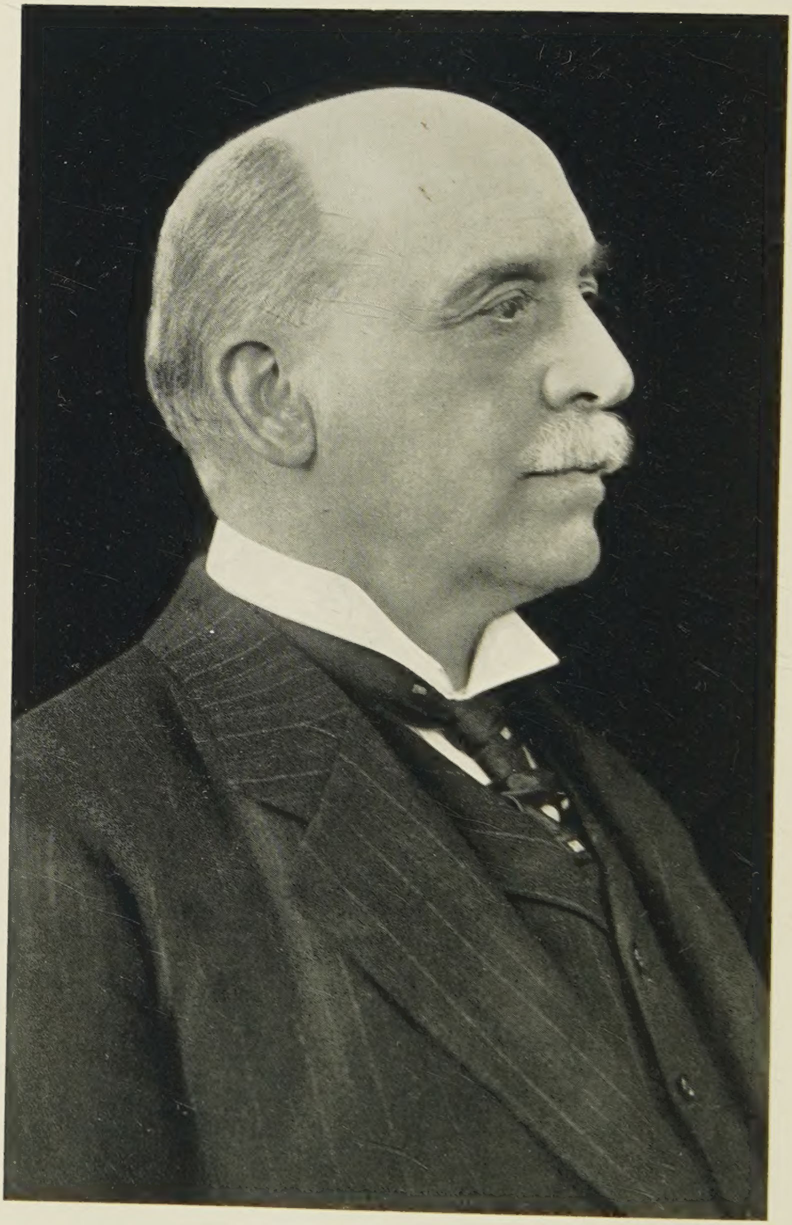

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WEETMAN PEARSON, FIRST VISCOUNT COWDRAY

WEETMAN PEARSON
FIRST VISCOUNT
COWDRAY

1856 - 1927

By

J. A. SPENDER

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With Seventeen Half-tone Plates

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PREFACE

The reader must be left to form his own judgment on this book, but, without anticipating that, I may be permitted to say that the writing of it has been to me a continuous revelation of the power, energy and intellectual grasp which one man of high ability may bring to the advancement of material civilization in the world. It is generally taken for granted that statesmen, poets and men of letters should be given the tribute of biography, and to some of them the epithet of " great " is rather indulgently conceded. But the achievements of constructors, engineers and pioneers are far too seldom recorded, and if this book should help to redress the judgment which assigns to them a secondary position, it will have served one of its purposes.

And perhaps, as I am writing of an old friend, I may be allowed to say that the " capitalist " revealed in these records presents none of the features commonly assigned to that type in current controversy about social systems. He is not overreaching or grasping ; he is careful and considerate of his workmen ; he has from first to last no quarrel of his own with any body of them or any trade union ; large numbers of them come time after time long distances to obtain employment from his Firm. In his dealings with those who employ him he never seeks to amend a contract or evade its conditions when they prove unfavourable ; he never takes advantage of weakness or ignorance to secure gain for himself. In undertakings of great magnitude he relies not on legal guarantees or the letter of the law but on his own confidence that as he treats others fairly, so they will treat him. If he made a great fortune for himself he gave in return the best that he was capable of giving and has left a record which proves that fair dealing and good workmanship still have their reward.

In writing this book I have had the constant assistance of Annie Viscountess Cowdray, the present Viscount Cowdray and the Hon. Clive Pearson, and have been much helped by letters and personal recollections supplied to me by other members of the family, especially Mrs. Kinnell, Lady Denman, Lady Lobnitz, Lady Watson and Mrs. George Whiteley. The technical parts could not have been written without the ever-ready assistance of engineers and other experts who took part in the enterprises described, and I can only hope that I have not misinterpreted their patient explanations to me of processes which necessarily seemed complicated to a layman.

To Mr. Cecil Reed, who was for twenty-four years Private secretary to the late Lord Cowdray, I am under a special obligation for the care and pains with which he collected the material on which this biography is based, and obtained for me all necessary details from the archives of the Firm.

J. A. S.

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LIFE OF LORD COWDRAY

CHAPTER I

THE BEGINNINGS

Samuel Pearson of Scholes—His Characteristics and Methods—His Son George—Formation of S. Pearson & Son—Birth of Weetman Pearson—The Move to Bradford—Weetman as a Boy—Schooling at Bradford and Harrogate—Home Life—Into the Business—Travel in America.

THE Firm of S. Pearson & Son, made famous by the achievements of Weetman Pearson, the subject of this memoir, had its beginning in the year 1844, when his grandfather, Samuel Pearson of Scholes in the West Riding of Yorkshire, became associated as partner in a building and contracting firm in the town of Huddersfield. Samuel Pearson, as he used bluntly to confess, was no scholar, and for a large part of his life he did his accounts in a cipher of his own invention; but he had a remarkably good head for figures and a thorough understanding of every sort of work that he undertook. He lived all his life in the village of Scholes, and seldom got up later than 4 a.m. or went to bed later than 9 p.m. Frequently when the firm had contracting work near Skipton, he would make the journey from Scholes (five miles walk to Bradford and train to Skipton twenty miles) and be on the works by seven in the morning. He had his ups and downs in his contracting ventures and was always prepared to take risks, but on the whole he did well, and when he died in 1884 he left £20,000. He loved farming and lived in a farmhouse; and as his business succeeded, he acquired a certain amount of land, of which he cultivated a part, and used the rest as grass-land for his horses.

Samuel Pearson married twice, first Elizabeth Asquith, who died in 1849, and second Elizabeth Squire, who died in 1907. He had four children by his first wife, and in 1856 he brought the eldest of them, George, who was then twenty-two years old, into the business, and so founded the Firm of S. Pearson & Son. At the age of seventeen George is described as being a healthy and fearless lad; and when the firm opened up brickworks on the Whitehall Road, Cleckheaton, and older men objected to staying there at night on the ground that it was a lonely place near a highway much frequented by tramps and evil characters, he faced it without a qualm. When he was twenty-one years old, George married Sarah Weetman Dickinson, daughter of Weetman Dickinson of High Hoyland, Yorkshire, whom he seems to have met while engaged on a contract on her father's land, and the newly-married couple made their home at Woodfield House, Shelley, in the parish of Kirkbarton near Huddersfield, where his eldest son, Weetman Dickinson Pearson, with whom this book is concerned, was born on July 15, 1856.[1]

In the meantime the Firm had prospered, and in 1857 it obtained a considerable contract from the Lancashire and Yorkshire Railway, both for the construction of new works and for the upkeep of a section of the line. At the same time it was engaged on a new water supply for the town of Dewsbury and various other undertakings which took it far outside its original sphere of operations in and around Huddersfield. Samuel Pearson accordingly decided to move his business to Bradford as a more convenient centre, and though he himself continued to live at Scholes, his son George moved with his family to Bradford. There the young Weetman spent most of his early years, and as soon as he was old enough was sent to the private school known as "Hallfield," in Bowling, Bradford, and from that was moved on at the age of thirteen to a boarding-school at Harrogate, Pannel College, of which Mr. Thomas Watson was head-master. More than forty years later, when Mr. Watson retired and his old boys made him a presentation, Weetman, now become Lord Cowdray, doubled the amount collected, and wrote a letter in which he expressed his " great admiration for Mr. Watson," who " always brought out what was best in his pupils," and whose " manner and straightforwardness endeared him to all those of an age that enabled them to appreciate his sterling qualities."

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[1] George Pearson had seven other children: Mary Adelaide, who married Mr. Herbert Brookfield and died in 1917; Laura Isabel, who married Mr. W. A. Paget Critchley; Florence Eliza, who married Mr. D. H. Brandon; Lizzie Georgina, who married Mr. (afterwards Sir) Frederick Lobnitz; Edward Ernest (afterwards Sir Edward); Janie Amina, who married Vice-Admiral (afterwards Sir) Hugh Watson; and Frederick George Waites.

The young Weetman is described by those who remember him at this time as a " lively but thoughtful boy." He knew how to ride and stuck manfully to the grey pony which ran away with him. He was devoted to his parents, and especially to his mother, who is remembered by all who knew her as a woman of charming personality, with not a little of the strong will and determination to overcome obstacles which were afterwards the leading characteristics of her son. Another member of the household during these years who is still living, was Miss Dickinson, sister of Mrs. George Pearson, the aunt who was greatly beloved by the children and became a strong influence in their lives as they grew up.

Harrogate had been chosen for the boy's schooling on account of its bracing air, and in that respect it seems to have been entirely successful, for at the age of sixteen he is described as " self-reliant and in vigorous health." What exactly he learnt at school is not recorded, but his bent from the beginning was towards mechanics and mathematics, and, in these respects at all events, he appears to have laid a thoroughly good foundation to build upon in after life. Whatever else his teachers may have taught him, they seem to have been strong on the point of handwriting, and he came away from school with the neat and legible hand which in after days made the hastiest of his pencilled notes as clear as print. But for better or worse his schooling was over by the time he was sixteen, and after the summer term of 1872 he returned to live with his parents at Bradford.

Two little diaries kept by fits and starts during 1872 and 1873 give some hints of his character and his family's way of life at this time. He was taken for a jaunt to London in the summer holidays of 1872, and stayed at the " Golden

Cross," Charing Cross, with a party of relatives. The routine of sight-seeing was the normal one—Tower, House of Commons, Crystal Palace, and the trips by penny steamboat which were the delight of youthful visitors to London in the 'seventies. One entry records that he "wound up with Surrey gardens (£3 10s.)"—which seems a liberal expenditure for a boy of sixteen on that vanished pleasure-ground. Returning home, he records the names of guests at a tea-party, and characterizes one lady as "Miss Pouting-lip." Then the family goes to Morecambe and the entries are of walks and bathing. By the middle of September he is back in Bradford, and being launched into the business. "Went with Mr. Hardwick to Leeshaw to learn to survey and level;" "Went with Mr. Hardwick to Oxenhope to get a parliamentary survey of the new reservoir on the Moor, stayed the night and finished the work next day," are among the entries. At the beginning of October he becomes a subscriber to the Mechanics' Institute Library and French class, and attends the class for the first time. Earlier in the year his father had promised him that he could go to France in the following year if he knew as much of the French language as would get him through a journey in that country.

That journey did not come off, for in the following year he records that his parents themselves have "set off for Paris" and that "in father's absence, I am manager over the yard of Oxenhope Tunnel[1] and Rollingbed steel works." He had in the meantime been initiated into the mysteries of brick-making, and is making intelligent inquiries about silica bricks and the price at which they can be got for the Rollingbed steel works. In the following year, 1874, at the age of seventeen, he is actually in responsible charge of a brick-yard. Now he writes down his tasks for each day: "Every Saturday, repair brick tables, moulds, dust-boxes, shaft mattocks, etc.; clean up shop and tidy up yard. See if any roofs, floors or spouting require repairs;" every Monday "see joiners and ascertain if any orders will be required for coming week; see blacksmiths and find out what material will be required for the week." And so on for every day of the week, with precise directions for horses and carts and a weekly examination of each. The quantities of everything were to be observed. "See the quantities of bricks made daily, measure the quantity of pipe-clay ground," etc.

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[1] Part of the Bradford Waterworks scheme for which the Firm had a contract.

As the months go on, the handwriting becomes firmer and the notes more elaborate. The business habit now rules in everything. From 1872 onwards his account with his father for money entrusted to him to spend (5s. per week pocket-money, 18s. for boots, etc.) is an elaborate affair of double-entry, and headed "Mr. George Pearson to W. D. Pearson, Dr."

From the beginning he had been intended for the business; there never had been any doubt about that either in his own mind or that of his parents. Fifty years later a lad so circumstanced would probably have been sent to the Imperial College of Science, and then passed on to the Engineering School at either Oxford or Cambridge. In the 'sixties and 'seventies it was still an axiom with parents who were in business that their sons should "learn their business in the business," and for exceptionally gifted lads like young Pearson it was, if not the best, a very good way. No one in later life was more rapid and accurate in working out the theoretical side of his problems, and in one way or another he got all the scientific training that was needed for this purpose, but the keen eye for detail and all but miraculous instinct for measurements and quantities which served him so well in his great undertakings undoubtedly owed a great deal to his early discipline in the Bradford brick-yard. The world in which he lived in these years was a world of planning, making, and constructing in one material or another, and he worked backwards from the practical to the theoretical.

After two years of this hard work came a great diversion. His father decided that he should go for a four months' tour in America with a roving commission to keep his eyes open for business, especially the business of bricks, glazed tiles and sanitary piping, the manufacture of which in their works at Bradford was now a speciality of the firm and one of the chief sources of their income. So on July 15, 1875, his nineteenth birthday, he set sail from Liverpool as a second-class passenger on the Inman liner *City of Richmond*, which, to quote his own description, was " a splendid ship of 3,000 tons, over 400 ft. in length, with accommodation for 140 saloon and 1,360 steerage passengers, three masts, three decks and 150 sailors." If she had anything like her full complement, the population of this 3,000-ton ship must have been somewhat congested by modern standards, but he had a comfortable berth amidship, and reports no worse hardship than being kept awake at night by a donkey-engine which did a spell every four hours. Except for the sighting of two icebergs which he described as " extraordinarily beautiful with battlements like feudal castles," the passage seems to have been smooth and uneventful. He landed in New York nine days after leaving Liverpool, and put up at Barnum's Hotel.

From this time onward to his return he kept a daily diary which shows a shrewd eye both for American characteristics and for the possibility of doing business in America. A glance at this may help to show the sort of lad he was at the age of nineteen and incidentally recall a past which the subsequent years have all but obliterated. Some things have not changed. Immediately on landing he notes the " hurry, bustle and excitement " of New York, and the apparent equality of its inhabitants. Walking in Central Park, he finds it " impossible to distinguish the gentleman of means from the working man, it being the custom here for the latter always to dress in an evening after work, and very well he does dress." In the same park boxes like doll-houses are attached to the trees for the accommodation of sparrows newly imported from Europe, which the Americans were trying to acclimatize, and apparently with success, for the birds are said to be " very fat and tame." There is " an enormous number of four-wheeled buggies with spindle-wheels and fast trotting horses," and " small buggies for children drawn by two goats and a footman running alongside." The streets of New York are " very badly paved and some even unsafe for driving in after dark." There are no sky-scrapers, and Brooklyn has still to be reached by ferry, but Brooklyn Bridge is building, and he is all admiration for its splendid design and daring construction. He visits the Navy yard in Brooklyn and finds it to be " a gigantic place and very clean," but can "see no difference between their workshops and ours."

Leaving New York he goes up the Hudson by steamer to Albany, noting the beauty of the scenery on the way, and thence takes train to Montreal, where he sees fine buildings but "bad quality of bricks." On the Sunday he goes to church three times—to the English Cathedral, an "independent Chapel" and the French Cathedral. At Montreal he postpones his departure for a day to "see a pipe agent." Then he takes rail and steamer on Lake Ontario, past the "Thousand Islands," to Toronto—keeping an eye on bricks all the time—and after that spends a day or two at Niagara, where he is disappointed with the Suspension Bridge, though not with the Falls. Thence to Chicago, where he falls on a World Exhibition, and sees being exhibited for the first time the "long-talked-of reaper which cuts the grain and turns it out at the back, bound and all ready for shocking." Except for agricultural machinery, he finds the Chicago Exhibition "far behind Leeds," but the place itself he considers a "wonder of the world." After four years there is scarcely a trace of the fire and the roads are broad and well-paved. At Chicago he finds out all about the drainage system and water supply, and describes an ingenious method of getting water from the Lake four miles from the shore and passing it through a tunnel underneath the Lake which conveys it to the Pumping Station without contamination by the shore water. Here again he is on to bricks, and discovers a patent kiln recently invented, and getting into touch with the inventor and President of the Company, suggests a mutual arrangement with S. Pearson & Son. He visits the stockyard, but is disappointed to find it is not a "killing day."

Thence to St. Louis, where he puts up at a bad hotel kept by an "old man of sixty with wrinkled face and jet-black dyed hair and whiskers, looking like a waxwork murderer." He notes that dyeing is very common in America, even among young men. The bridge over the Mississippi at St. Louis he considers to be "the finest feat of engineering skill in the world," but he is not otherwise greatly impressed with the place. From St. Louis he takes a river steamer the whole 1,250 miles to New Orleans and becomes a little tired of his own company during the next three weeks. It is the river of Huckleberry Finn, and the flat-bottomed steamer scrapes the bottom, bumps into the shore, is held up all night by fogs and shoals, and has to wait for the Government "snag-boat" to clear the trees that are drifting in the fairway. But part of the way the "scenery is magnificent," and there is interest in watching the niggers at work and listening to their songs and visiting the floating stores of pedlars which serve as shops for the river population. As they get south and pass Vicksburg, he notes the traces of the Civil War and the derelict black as well as the impoverished white people. One hardship continues all the way. "One end of the saloon is rigidly restricted to ladies and gentlemen accompanying them," and being a solitary young man he is railed off from that privileged enclosure. There are young ladies on board, but "they are of the haughty south and won't speak."

New Orleans he considers to have the finest streets in America, and the country round by the shores of the Gulf of Mexico is an "earthly Paradise." The Capitol at Washington and the Treasury Building fill him with enthusiasm, but at Baltimore he spends a whole day in finding out a sewage-pipe works, and then, being unable to get into it, "inspecting it from outside." At Philadelphia he duly visits Independence Hall and the Museum, but once more he is after brick-yards and notes a special kind of fine brick that is new to him. The streets of Philadelphia are "very narrow and awkward," but "the people healthy and better-looking than in other cities probably owing to the Quaker nature." A description of a fine travelling crane completes the entry for Philadelphia. A few days later he is back in New York, whence he sailed home in the *White Star*, a ship of 5,000 tons, and the diary fades out after two days at sea, when, as a later note records, it was stopped by "sea-sickness." The whole tour cost $647.60, and every item of expenditure is carefully noted down in the account prepared for his father.

The *Edgerton Independent* (Edgerton, Wisconsin, August 27, 1875) records an incident which is not mentioned in the diary or apparently in his letters home:

"Albion, Aug. 23, 1875.—Mr. W. D. Pearson, a young gentleman from Bradford, England, who is visiting at Mrs. Eliza Dickenson's, in this town, while handling a loaded revolver, accidentally shot himself in the left hand. The ball entered the palm, and passed nearly through, lodging beneath the skin at the back of the hand. The ball was a very careful and considerate one, as in its expeditious course it avoided the bones, and selected a route calculated to inflict as little injury upon its victim as possible. It was extracted by Dr. C. R. Head, who dressed the wound in his usual skilful manner. Mr. Pearson is to be congratulated that the accident did not result more seriously."

CHAPTER II

THE JUNIOR PARTNER

In Charge at Southport—A Difficult Contract—Junior Partner—Retrieving the Fortunes of the Firm—The King's Lynn Dock—Marriage—Extending the Firm—The Move to London—Early Years in London—A Railway in Spain—Alexandria Harbour—Milford Haven—Halifax Graving Dock—Railways in England.

THE good opinion which young Pearson had won for himself may be judged from the fact that on his return from America in 1876, when he was hardly twenty-one years of age, he was entrusted with the personal superintendence of one of the Firm's most important contracts, that for the construction of a new main drainage system for the town of Southport in Lancashire. In after days he was in the habit of describing this as one of the toughest jobs he had in all his life. The greater part of Southport is built on sand, and to provide a durable bed for sewers in its shifting subsoil, much of it sodden with water, was a task of uncommon difficulty which might have tested the most experienced engineers. But already he had the temper which welcomes a challenge, and he faced up to this one with the zest of youth. His father came to the rescue in extreme emergencies, but for the most part left him to grapple with the difficulties in his own way, and when finally they were overcome, the credit was mainly his. Compared with the great contracts of subsequent years this Southport undertaking was but a small affair—merely a matter of £70,000—but it remained in his memory as one of the two or three that had taught him most. Among other things he had for the first time on this occasion found himself in charge of a considerable body of workmen and was judged to have shown tact and discretion in handling them. When the Southport work was finished he was permitted another breathing space, and in the spring of 1879 he spent several weeks in Palestine. Of this tour also there is a diary; it seems to have made a lasting impression on him and he often spoke of it in later years.

The Southport scheme took the greater part of the three years 1876–78, and decided the young Pearson's position in the Firm. In 1879 when he was just twenty-three, his grandfather, Samuel Pearson, went out of the business and gave him his share. He thus became his father's sole partner in the Firm of S. Pearson & Son, and as successor to his grandfather had his own independent interest in it.

Enough has been said to show that Weetman Pearson was not, in the ordinary sense, a self-made man. He had been brought up by parents in easy circumstances; he had had none of the struggles of young men striking out a path of their own, but on the contrary the certain prospect of going into a well-established business and easy and obvious means of getting the training necessary for that purpose. These were great advantages which he himself certainly never underrated. But he was, nevertheless, to an immense extent the maker of his own fortune and that of the Firm. In a talk I had with him about his early life, a few years before his death, he told me that as soon as he became a partner he had immediately to face the fact that the Firm had an overdraft at its bankers largely in excess of what he considered to be warranted by its assets and prospects. In this sense he started from scratch, and his first years were years of intense and anxious work to maintain the credit of the Firm and to lay a solid foundation for the future. Next to starting a new business, there is no more formidable task than that of pulling an old one out of a rut, and this fell to the young Pearson in his twenty-fourth year.

Recovery at the moment depended on the profitable handling of two contracts, one for the construction of a main drainage system at Ipswich and the other for a dock at King's Lynn. Pearson took the personal superintendence of both undertakings and carried his supervision to the last detail. The technique of works of this kind will be described in subsequent chapters dealing with the greater undertakings of the Firm, and I need not enter into it here, but King's Lynn presented on a small scale most of the problems—dredging, construction of sea-walls with under-water foundations, the use of concrete blocks, etc.—which confronted him on the big scale in later years, and he often said afterwards that he learnt a great part of his business as dock and harbour constructor in the Norfolk port. For Ipswich he had been prepared by Southport, which was by far the more difficult problem, but here, too, the Firm greatly benefited by his close personal supervision.

After two years of this work he saw his way clearly ahead, and in 1881 there took place what he always described as the most important event of his life, his marriage with Annie Cass, the daughter of Sir John Cass of Bradford. He never was in any doubt about his choice and was characteristically persistent in his wooing. That began in 1879, at a party invited to inspect the souvenirs and presents that he had brought back with him from Palestine. Among these was a bible bound in olive-wood which he announced to the company was intended for his future wife, and, as the party broke up, he offered it to Annie Cass, then a girl of seventeen. She would have none of it and tossed her head and told him he was a cheeky lad, but a year later he offered it again, and this time she accepted it without hesitation. Forty-six years later, in his last written word, he was to pay her one of the finest tributes that a wife ever received from a husband, and for all these years she was to him a comrade in arms, who fought every battle by his side and shared to the full his love of adventure and the fighting chance.

The newly married couple took a house at King's Lynn, and Pearson settled down to the completion of the dock. Mrs. Kinnell, his wife's sister, then a child of twelve, has a vivid memory of a visit paid to them in these days. He was out all day and after dinner at night would go to his study and work on his accounts or plans till two in the morning. Now and again the child contrived to secrete herself when her sister went to bed and sat curled up on a sofa in the study watching her big brother-in-law at work. He was apparently unaware of her presence except at half-hour intervals, when he got up from his table, walked over to the sofa and kissed her and returned without a word to his papers.

By the time the King's Lynn and Ipswich contracts were disposed of, the unsleeping junior partner had his plans laid for developments farther afield. The Firm was to cease to be a local one; it was to claim its place among the great national contracting firms and bid boldly for big business all over the world. By this time he was beginning to be known as a young man of great organizing ability and remarkable skill in overcoming difficulties which had baffled his seniors, and he saw no reason why his horizon should be bounded by Yorkshire and the Eastern Counties. In 1882 he made his entry into the London field with a tender which was accepted by the Metropolitan Board of Works for the construction of the Deptford storm outfall sewer. This in itself was no great matter, but it placed him definitely on the London map, and two years later (1884) he took the step which had long been in his mind, of transferring the headquarters of the firm from Bradford to London. The first London office was in Delahay Street, Westminster, a famous nest of engineers and contractors since demolished to make room for Government Offices. The family followed the Firm, and established themselves on Campden Hill, first at 4 Durham Villas and then at 16 Airlie Gardens. By this time Pearson was the father of two children, Harold, born in 1882, the present Viscount Cowdray, and Gertrude, born in 1884, now the wife of Lord Denman. Two other children were born in the next seven years, Clive (1887) and Geoffrey (1891). In 1888 the Firm moved to 10 Victoria Street, and in 1906 added the great office in 47 Parliament Street—formerly the Whitehall Club—which is now their principal abode.

After the move to London the young Pearson was to all intents and purposes head of the Firm, " the Chief " of subsequent years, and his father was well content that he should be. From the time that he had proved himself in the Southport contract, more and more had been passing into his hands, and latterly he had been heard to whisper, " Can I leave this to father ? " George Pearson is described by those who knew him as an engaging and rather flamboyant personality, but very unlike a successful man of business. He was tall, handsome and well-dressed, had a sharp and clever tongue, took his work lightly and liked to travel and enjoy himself. When his son was still in his teens he would depart suddenly and leave him to get in the money and pay the wages and wind up the week's work. The son always spoke with admiration of his father's ingenuity and resourcefulness, when he chose to apply himself to business, but their temperaments were so different that friction between them was inevitable, and the younger man was often galled by his father's sarcasms. He came one day to his mother to say that he was at the end of his patience and had decided to "go on his own," but at once put that thought behind him when she replied, "You must stay for my sake." Many times in later days she spoke of him as a "second father" to his seven brothers and sisters.

But as Weetman Pearson went ahead, so George Pearson faded into the background, and there are few traces of his handiwork in the records of S. Pearson & Son. When the Firm moved to London he, too, came south and bought a property at Brickendonbury in Hertfordshire, where he lived until his death in 1899, and where his son Edward lived in after-days. Mrs. George Pearson survived her husband for twelve years, and she and Weetman were always on terms of the warmest affection.

Success was now continuous and unbroken, even overwhelming, and within five years Pearson was in the highest flight of his own business and becoming widely known as a man to be reckoned with. In 1894 he was created a baronet, in those days counted signal promotion for a young man who only ten years earlier had come to London to seek his fortune. But this prosperity had to be bought by incessant and exhausting toil. He did everything himself, down to the smallest detail; his wife furnished the office rooms, and they spent their Saturday afternoons together at Delahay Street tidying up after the staff had gone. For eight years he took no holiday, and was often so exhausted that when the Bank Holidays came he went to bed and slept through them. As the Firm prospered he took more leisure and spent and gave his money freely. In 1898 he moved to 16 Carlton House Terrace, but in the meantime (1894) he had bought the estate of Paddockhurst in Sussex, the property of Mr. Whitehead, of torpedo fame, who built the substantial modern house which Pearson enlarged and largely rebuilt. The property, when he first bought it, consisted of about three thousand acres, but has been enlarged by subsequent purchases to about double that area. It is composed of woodland and farmland in one of the most beautiful regions of the Home Counties, and extends from Three Bridges through Rowfant to Balcombe House and Park, which also he bought subsequently and presented to his daughter, shortly after her marriage to Lord Denman. All the time that he could spare out of London or from his incessant business journeys during the next seven years he spent at Paddockhurst with his wife and children, and very often a houseful of guests. No sooner was he in possession of this estate than he was at work altering, planning, levelling, developing, making ponds and lakes, installing new water supplies or shifting old ones. There were times when his estates seemed for long periods to be the scene of extensive public works. But he and his wife together made beautiful gardens, and many of his happiest hours in these years were spent in these occupations at Paddockhurst.

When in London it was his habit to begin the day by riding in the Row, or further afield, if time permitted, with his wife and sister-in-law, and in later years with his daughter. While he rode he also exercised his mind by explaining to his companions some of his more difficult problems. When bicycling came into fashion he learnt with some difficulty to ride a bicycle, but his absorption in business when mounted on wheels became dangerous to life, and this form of exercise had to be abandoned. It is commemorated, however, in a frieze by Walter Crane depicting the family on wheels, which adorns the morning-room at Paddockhurst. Later his daughter endeavoured to teach him to drive a car, but he handled the wheel as if he were driving a traction engine, and this also was judged too precarious to be continued. As he grew older his chief recreations were golf and shooting. He was a good shot, considering how little time he gave to it, and had many shooting parties on his own estates.

In the five years after it had established itself in London, the Firm obtained contracts all over the world, and Pearson travelled widely and rapidly between one and another. Before the end of the year 1889 he was at work on important dock and harbour schemes both at home and in Egypt and in Canada ; he was building several railways ; he had undertaken the Hudson Tunnel in New York, and obtained the contract for the Grand Canal in Mexico. The more important of these enterprises were spread over several years, and will be described in detail in subsequent chapters, but something may be said here about others, which, if not of great magnitude as measured in money, yet played an important part in building up the reputation of the Firm in its early years.

In the year 1888 the Firm started on its first railway in a foreign country. This was a Spanish railway from Avila, on the Northern Trunk Line, to Salamanca, an obvious improvement in the Spanish railway system, since, though only sixty-five miles long itself, it shortened the route between Madrid and Lisbon by sixty-six miles, and between Madrid and Vigo by one hundred and thirty miles. The engineers were Sir J. Hawkshaw, Son and Hayter, and the company which undertook it was entirely British. There were many difficulties. Much of the ground was precipitous and called for tunnelling and deep cutting. During a considerable part of the year the climate was bad, and the labour conditions were never easy. A destructive storm in October, 1890, put the uncompleted works to a severe test, but they suffered no worse damage than the removal of a section of the coping from one of the bridges and the choking of a small cutting with sand. The contractors did their part of the work punctually and efficiently, and it was no fault of theirs that it was brought to a standstill before it was finished by difficulties between the promoters and concessionaires. Pearson was all over the ground himself, and his wife went with him, and shared the rough quarters, bad food and exposure to all weathers which were the portion of the railway constructor in the wilds of Spain. His staff said afterwards that Mrs. Pearson had saved their lives by going ahead and seeing that hot food and dry sheets were waiting for them at the end of the day's march or ride.

In 1889 the Firm obtained contracts for widening and deepening the entrances to the port of Alexandria, which, though a comparatively small operation, yet required skilful handling. At this time the main port of Alexandria—the Eunostos of the ancients on the western or African side—was more or less blocked by a series of sunken reefs, which made the entrance difficult or impossible in bad weather; and could even in good weather only be entered by the larger ships through one channel known as the Boghaz Pass. This had a dangerous elbow in the middle of it, which had to be removed, and the contractor's task was to drive through it and construct a straight channel about half a mile long, 300 ft. wide and 30 ft. deep. Pearson went to Egypt, and having carefully examined the problem with his engineers, came to the conclusion that no ordinary dredging apparatus would be equal to it, and gave an order to Simons & Co. of Renfrew for a specially designed rock-dredger capable of lifting 400 tons per hour. This was launched in December, 1890, and reached Alexandria a few months later after a stormy and adventurous voyage. To keep it steadily at work in the heavy swell at the mouth of the harbour was no easy matter, but it answered all expectations, and in the course of the next three years removed 30,000 cubic yards of rock, and constructed the channel according to specification. The increase in the trade of Alexandria since this date bears its own witness to the importance and value of this improvement.

The Dock and Harbour works of the early years include large undertakings at Milford Haven (1885–90) and Southampton (1886–91) and at Halifax in Nova Scotia overseas (1886). Milford being two hundred miles nearer America than any other British port, and having the advantage of deep water and safe harbourage, had at one time great expectations of playing a leading part in the Atlantic trade, and the scheme which the Firm completed in 1889 left it provided with a graving dock over 700 ft. long and wet docks capable of accommodating a dozen big liners at one time. In the subsequent years Southampton has realized what are still hopes for Milford Haven, and the dock constructed by the Pearson Firm at Southampton has played a great part in its development. The plan for this required a deep-water area of eight acres with a depth of 26 ft. at low water spring tides, with wharves on three sides, 800 ft. long, disposed in the form of a diamond-shaped trowel with the handle representing the mouth. An enormous excavation of "slobbery" mud and clay, on which it was impossible to lay rails for steam navvies, had to be accomplished by hand labour, and the building of the north wall was attended with unexpected difficulties. For reasons which never could be ascertained a large part of it suddenly collapsed and had to be rebuilt on a foundation 10 ft. deeper than the specification provided for. Then when the east wall was finished, and the dock was about to be flooded, a fracture appeared in that also, and more than half of it had to be rebuilt. This delayed the work and caused the Firm to forfeit the premium which they had expected to earn by its completion in advance of time, and altogether involved them in an additional expenditure of between thirty and forty thousand pounds for reasons which were in no sense their fault.

The graving dock at Halifax, 580 ft. long and 100 ft. wide, a space large enough to accommodate the largest warships and commercial ships then on the sea, required an enormous excavation of solid rock, but otherwise presented no difficulties. The work took three years and was carried out in association with S. M. Brookfield Ltd., contractors of Halifax, N.S. Mr. S. M. Brookfield superintended the operations of this dock from the date of its completion in 1889 until 1917, when it was expropriated by the Canadian Government. It was badly damaged by the disastrous explosion which took place at Richmond, Halifax, in 1917, and the cost of its repair became the subject of some contention.

In 1893 came the deepening and enlarging of Bermuda Harbour, undertaken by the Colonial Government to meet the great increase in the size and draught of ocean-going steamers. This, like the similar project at Alexandria, was the simple, if stubborn, problem of cutting through ridges of solid rock. Once more Pearson decided that it was beyond the capacity of any existing dredger, and sat down with his brother-in-law, Mr. (now Sir Frederick) Lobnitz of Renfrew, to design a new one which should be the most powerful ever built and capable of crossing the Atlantic under her own steam. The dredging engines had a thousand horse-power, with a working pressure of 160 lb. per square inch, and the rock-breaking apparatus was fitted with a cutter consisting of an iron bar, weighing ten tons, with hard steel chisel-point. This monster apparatus, built by Messrs. Lobnitz, made the voyage safely from Glasgow to Bermuda in about six weeks (May 13 to June 17, 1894), and in the next eighteen months succeeded in deepening and widening the Staggs Channel and Two Rock Passage to the prescribed extent.

During the same years the Firm was busy on various railway contracts in England. The Lambourn Valley Railway—a single standard gauge line twelve and a half miles in length, linking up the town of Lambourn with Newbury, and thus connecting it with the Great Western system and the Newbury and Southampton line—was light work for the Pearson Firm, but in its way a *tour de force*, since it was completed within ten months of the signing of the contract. Seeing that its engineering features included an iron bridge of five spans over the River Kennett, a score of small bridges and several deep cuttings through chalk, chalk marl and gravel, this was a spirited effort. Another interesting contract was with the Great Western Railway for the change from the old broad gauge and the doubling of the track in the picturesque section of their main line between Brent and Hemerdon, Ivybridge and Cornwood, a distance of about twelve miles. The main problem here was the strengthening and partial rebuilding of five viaducts (including the famous Ivybridge viaduct) of from seven to fourteen spans and varying in height from 70 ft. to 120 ft. Brick-works and brick-making always interested Pearson, and for the viaduct arches alone four million bricks were required, in addition to a great quantity of granite which was obtained from a quarry at Ivybridge opened up for the purpose by the contractors.

A more formidable railway undertaking was that of the Lancashire, Derbyshire and East Coast Railway (1892–97), projected originally to extend right across England from Warrington at the head of the tidal section of the Manchester Ship Canal, through Macclesfield, Buxton, Chesterfield, Lincoln, to Sutton-on-Sea, a village on the Lincolnshire coast. The new coalfields which were being opened up in

Derbyshire and Nottinghamshire had long made the eastern part of this project urgent, but it had been held up by the rivalry of the great Companies, none of which could afford to let a competitor undertake it without entering a strong opposition before the Parliamentary Committee. The difficulty was overcome by the formation of an independent Company, which carried its scheme through Parliament and entrusted the Chesterfield-Lincoln section to the Pearson Firm. Pearson began by laying a temporary railway to convey men, implements and machinery from Chesterfield to Warsop and established a colony of workers at Callon, where he soon had a thousand men at work, and provided them with living accommodation, club and dispensary. At this centre he next set up a brick-making establishment capable of turning out 100,000 bricks a week, blacksmiths' shops, carpenters' shops and sheds for the eight locomotives employed on the work. The main organization being thus provided, the rest was straightforward work which was punctually completed, but it included several interesting features, such as the long and lofty viaduct with its complication of square and skew arches on the way out of Chesterfield, and the mile-and-a-half Bolsover tunnel, which is so straight that on looking through daylight can be seen at its far end. The driving of this tunnel was not quite so simple a matter as might seem, for the contractors first struck coal-measures of a highly treacherous character, then a stubborn section of magnesium limestone, and were finally flooded out by a rush of water which had to be carried off by the building of arches underneath the track. This line, which invades the Dukeries, skirts the old Sherwood Forest, and passes within sight of Welbeck, Clumber, Thoresby and Rufford, was deplored at the time as the violation of these sanctuaries, but has been long accepted as an inevitable part of the coal development which has so greatly enriched this neighbourhood. It was later absorbed by the Great Central, but its seaward connexions have not been thought necessary, and the village of Sutton-on-Sea in Lincolnshire is still baulked of its ambition to be a thriving coal-port.

In the spring of 1899 Pearson was travelling in Greece and Italy and developing the liveliest interest in archæology, to which he brought the engineer's eye and mind. Again and again he was ready with solutions of structural problems which had puzzled the experts, and nothing interested him more than to conjecture the uses of ruined fragments to which no purpose could be assigned. As between Greek and Roman architecture he characteristically preferred the Roman, and was lost in admiration of the massive and daring designs which the Roman builder had accomplished with hand labour. As he stood in the Coliseum he made rapid calculations of the time it must have taken to build, given that so many thousands of labourers were available, and of the cubic yards of masonry required. While he was in Greece the King sent for him and, after a friendly conversation, said he wished him to undertake the construction of the Larissa Railway. Up to that point he had been standing in the royal presence, but, " Now, sir," he said, " we must sit down and consider this as business." The plan did not go forward, but it was seriously discussed as between employer and contractor.

Though it belongs to a later date, it may be added here that shortly after the war it was suggested to him that he should permit himself to be nominated as Prince of Albania. Those who desired him to fill this exalted position saw him in their mind's eye doing for Albania what he had done for Mexico, and providing no doubt the capital as well as the brains. The idea had merit in it from the Albanian point of view, but it did not appeal to Pearson.

CHAPTER III

FINANCING THE BUSINESS

Contracts for Five Millions—A Puzzle and the Answer—Pearson's Correspondence with his Bankers—The Financial History of the Business—Small Capital and Great Undertakings—Pearson's Qualities in Business—The Evidence of his Notebooks—Incessant Hard Work—The Pearson Touch.

The contract for the Lancashire, Derbyshire and East Coast Railway described in the last chapter was for more than a million, and it was running simultaneously with others which brought the total cost of the work which the Firm had on hand at this time (1892) up to over five millions. This point was reached within eight years of the move to London, and within the next ten years the figure ran up to over fourteen millions. Such are the bare facts, but they raise a question which requires a little examination. How could one young man with almost nothing behind him, when he started, but the goodwill of a not very important local business have obtained the capital to finance this enormous business?

The brief answer is that it needed very little capital, or at all events that Pearson so worked it that it needed very little. This is brought out in a correspondence with his bankers which has survived from the early years. In order to use his own resources to the full and to expand his business when opportunity offered, he of course needed accommodation from his banker, but he reckoned throughout (1) on making his contracts finance themselves except during the initial stage before the periodical payments began to come in, and (2) avoiding as far as was humanly possible the miscalculations and accidents which might have delayed these payments or involved him in unexpected losses. He could thus work on the minimum of borrowed money and make a small capital suffice for great undertakings.

Pearson was always on the best of terms with his bankers, and some of them, like Sir Edward Holden, the famous managing director of the Midland Bank, were among his intimate friends in later years. But in the beginning they seem to have needed a good deal of convincing before they would give him even the moderate accommodation that his growing business required.

In 1886, when he had contracts running up to a million, we find him applying to the Yorkshire Banking Co. for an extension of his overdraft from £25,000 to £35,000, and the Bank objecting unless securities fully covering this amount are deposited with them. He enumerates the securities he is willing to put in, some of them his own private property (" deeds of two small properties worth about £2,000 ") and the rest the property of the Firm. But they include £16,000 5 per cent. Preference and £2,000 Ordinary Stock of the King's Lynn Dock Co., and £17,000 Milford Docks A Debenture Stock, which the Firm had accepted in part payment for its work on those two enterprises. The Bank questions the value of these securities, and though Pearson puts in a statement to show that he and his Firm would in the event of a winding up be worth many times the amount of the overdraft, his estimate of this incalculable event is coldly received, and it is only with great reluctance that the Bank permits him for one short period to draw up to £32,000. At times he grows impatient, and hints that he may have to look for his accommodation elsewhere. " As you are no doubt aware," he writes (June 27, 1886), " the business we are carrying on requires a very large amount of capital. From the position we have gained and now hold as one of the leading firms of contractors in the Kingdom, we have occasionally good contracts offered us with little or no competition, and such contracts we cannot decline. What we have to do is to be ready for them when they turn up, but a sudden reduction in an overdraft is rather inclined to upset one's calculations." The correspondence continues on these lines for the next year or more, the Bank continually asking for more securities when the overdraft exceeds £30,000. It is polite but persistent on this subject. Why, having the securities, should Mr. Pearson not deposit them with the Bank? It would establish confidence, make a good impression on the Directors. Pearson by now appears to have thought that the position of his firm was good enough to enable him to resist these blandishments, and again he hints that a great many others are willing to accommodate him.

The business expanded rapidly in the next four years, yet with estimates running into millions he appears still to have worked with the Yorkshire Bank on a standing overdraft of £30,000, though now with power to increase it for limited periods to £45,000 or £50,000. Then, in 1892, he opened an account in London with Messrs. Williams Deacons Co., and a memorandum prepared for them in April of that year shows the net assets of the Firm (apart from goodwill or value of the business as a going concern) as £290,000. The preamble of this gives his own account of the origins of the Firm and his estimate of his position at the time :

> The Firm of S. Pearson & Son consists of George Pearson and his son, W. D. Pearson.
>
> S. Pearson retired in 1879 and died shortly after, leaving £20,000.
>
> The Firm was established about 1850,[1] and until 1879 were Sanitary Tube and Brick-makers and Contractors for local Public Works in and around Bradford.
>
> Since 1879 the Firm has gradually extended its operations until it is now probably the first firm of Contractors in regard to the work it has on hand, and the third or fourth in regard to wealth.
>
> The Firm have never undertaken a Contract which they did not finish, nor since 1874 have they had a contract on which they lost money.

Accompanying the memorandum is a list of the Contracts completed since 1879, and of those then in hand, the latter including the Mexico Drainage Canal (£1,250,000), the Blackwall Tunnel (£870,000), the Central Section of the Lancashire, Derbyshire and East Coast Railway (£1,000,000), the Avila and Salamanca Railway (£500,000) and the Hudson Tunnel (£500,000). With net assets in hand of nearly £300,000, and these great works in progress, Pearson cannot be said to have exaggerated the resources and prospects of the Firm at this date.

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[1] The actual date of the foundation of S. Pearson & Son was 1856, but Samuel Pearson had been working with a partner for twelve years before that time.

Eighteen months later he is able to assure the Yorkshire Bank, that "we retain the whole of the securities given in the statement of assets and liabilities" (presumably the same that was given to Messrs. Williams Deacons Co.), and "our position," he adds, "has naturally improved since then. All our contracts are good ones; our means are exceptionally large, whilst our business (conducted as we conduct it) is as safe and free from risk as any business of any description." Finally, in 1900, he opened another account in London, and a memorandum which he prepared in 1900 for the new Bankers (Capital and Counties) shows the position of the Firm at this date. Though it anticipates future events this may be given here:—

> *30th January*, 1900.
>
> S. Pearson & Son was founded in 1856.
>
> W. D. Pearson became a Partner in 1879 and the sole partner in December, 1894.
>
> Owing to W. D. Pearson being a Member of Parliament, the Firm were precluded from carrying out Government Contracts; to get over this difficulty the Firm, at the suggestion of the Admiralty, was converted into a Limited Company in October, 1897, and the Contract for the Admiralty Harbour at Dover secured.
>
> The new Company took over the whole business of the old Firm.
>
> The capital of the Company is £500,000 of Preference shares all issued and fully paid and £1,000,000 of Ordinary shares all issued but only 50 per cent. paid. There is no Debenture issue. The capital of the

Company is owned by W. D. Pearson and family and the Directors. The Directors are:

W. D. Pearson	President of the Company.
Clarendon G. Hyde	Barrister, who has been working with the firm some 12 or 13 years.
E. E. Pearson E. W. Moir B. C. Cass	These are active Managers of various Contracts, and joined the Board this month.

The assets of the Company on December 31, 1898, were £869,000. These net assets are, of course, exclusive of goodwill or any value on the Contracts other than the actual profits realized.

The value of all assets is believed to be its realizable value and not its value as a going concern.

The profits of the Company for the year 1898 were £130,000. For the year 1899 we expect they will be equally good.

All the Contracts we have in hand, with the one exception of the Great Western Railway Contract on which a 5 per cent. loss is anticipated, are turning out as expected.

We have every confidence in stating that we see as bright a prospect in the future as the Firm has enjoyed for the last 25 years, during each year of which the Firm has increased in prosperity.

The Firm has never had a Contract that it did not complete.

Up to 1879 the Firm's operations were confined to the North of England. In 1884 it opened offices in London. To-day it is perhaps the leading Firm of Contractors; the only Firm of similar standing being John Aird & Sons.

The Firm's Bankers are the Yorkshire Banking Co. Ltd., Leeds, and Williams Deacons Co. Ltd. The former we have banked with since 1857 and the latter for some 15 years. We have overdrafts at each Bank to the amount of £150,000. As our business grows we must increase our Banking facilities.

The Firm pays all accounts monthly, has no acceptances and no creditors except its Bankers.

The Contracts we have in hand exceed some £9,000,000. Our turnover exceeds £1,500,000 a year, Our business has grown from one with some £30,000 of capital in 1875 to its present position; not by any fluke but by hard work, enterprise and care; each year, as we have said before, being an improvement on the preceding one.

We have large interests in Mexico, where for the last ten years we have been actively and profitably engaged.

The Tehuantepec Railway, 190 miles long, belongs to the Government. As Contractors we are building two harbours, one at each end, for this railway on account of the Government for cash. We have a partnership agreement with the Mexican Government for the working of such railway and harbours. Although they will have cost the Government some £6,000,000, we pay no rent of any kind. We merely have to manage the property and pay half the losses if we make any, but get one-third of any profit we make.

To consolidate some of our interests and prevent competition, we have just acquired the Railway from Vera Cruz to Alvarado, 41 miles, and the trams at Vera Cruz. We pay for them on Thursday the first proximo.

We now require a credit for £100,000 against the deposit of some £55/60,000 of Stock Exchange or dividend bearing shares and debentures and the deposit of the Deeds of the Wouldham Cement Works, the banking account for which you already possess.

The Cement Works we bought 18 months ago under very favourable terms. The position has some 800 feet frontage to the Thames; the freehold is some 17 acres or more; the chalk is inexhaustible at a low royalty. The Works when we bought them were turning out 450 tons of cement a week. We are now turning out 700 tons a week, and when the Works are finished, all

> the machinery for which may be said to be ordered, the output will be 2,500 tons a week. Cash outlay to date including purchase price is some £110,000; to complete £60/70,000 more will have to be spent during the next 6 months.
>
> We require the advance pending a mortgage on the works on completion or pending its sale to the proposed Cement Combine at the price of £375,000 half cash and half securities.

It will be seen that with contracts of about £9,000,000 on his hands he was now working with overdrafts at three banks amounting in all to £400,000, a sum covered many times by the realizable assets of the Firm. When, for the reasons stated in this memorandum, the Firm was converted into a Limited Company (October, 1897) Pearson left 50 per cent. of the 1,000,000 one pound ordinary shares—i.e. £500,000—as uncalled capital, in order to make it clear that he and the members of his family to whom these shares were allotted were liable to that amount in their private fortunes if ever the Company got into difficulties. This he thought necessary to prevent its being supposed that the Firm was seeking to limit its liabilities by coming under the Companies Act.

Such are the facts as brought out by this correspondence. Pearson told a friend in later life that when he came to London in 1884 he was worth no more than £30,000, yet within two years he is able to claim that S. Pearson & Son is "one of the leading firms of contractors in the Kingdom," and in the following three years he is seen launching out boldly into the biggest and seemingly the most hazardous enterprises; engaging in a series of operations in different parts of the world, each of which was a complete business in itself, and any one of which might, with a very little miscalculation, have been his ruin; and even when his contracts mounted up to three, four, or five millions, seldom drawing on his banker for more than £30,000. It looks an amazing feat, for one young man with no great resources behind him. Granted that he was greatly helped by the system which enables the contractor to draw his costs and profits piece by piece at short intervals, the acceptance of risks and liabilities on the scale that the young Pearson accepted them would almost certainly have brought disaster to any ordinary man; and the mere fact that he escaped disaster, let alone that he amassed a great fortune, must be taken as proof of the extraordinary qualities that he brought to his business.

What were those qualities? The answer will appear more clearly as the story proceeds, but certain things are evident from the start. He must, to begin with, have had a genius for organization. To get the right men as engineers and managers, to recruit labour and assemble the material for one railway would have sufficed for most men working by themselves, but Pearson seemed to think nothing of adding a dock to a railway, and a canal and a great drainage scheme to both. Next it is evident that he combined courage and caution in a very unusual degree. While never cowed by the bigness of any undertaking, or hesitating to add one big undertaking to another, he measured with the utmost exactitude the risk that he was taking and his own capacity to perform what he promised. What would have been blind gambling for a man of equal courage but less self-possession became in his hands a cool estimate of probabilities which seldom proved at fault. He judged with extraordinary accuracy the limits within which he could tender with safety, and earned prompt payment by good and punctual work. A too cautious man would have lost contracts by leaving himself too much margin, and a less prudent one have landed himself in trouble by underestimating his costs and risks. Pearson's skill and economic management enabled him to make handsome profits out of tenders which some of his competitors thought dangerously low, but he never for the sake of getting business put in a tender in which he did not see a fair prospect of profit; and when once started on a job he left nothing to chance, but watched every stage and every detail with unsleeping vigilance.

His note-books and the various stages of the specifications for his contracts bear witness to the enormous pains that he took. There is no trace at any moment of the feverish rush to get the job which has been the undoing of others in the same line of business. He takes nothing for granted, sanctions no method and uses no machinery which he does not thoroughly understand, and not infrequently works out estimates of his own, independently of those of his staff, and not until all this is done, and done over again if needs be, does he let his tender go forward.

Working in this way, he could safely undertake big business on a small capital and expand rapidly as opportunity offered. Having thoroughly prepared the ground, he was very seldom behind time or delayed by circumstances that he had failed to foresee. There was much talk in later days of the "Pearson luck," and certainly, in the course of his life, he had great strokes of good fortune, but the secret of his success in the early days and throughout his life was actually that he eliminated luck to the utmost that foresight and careful preparation could do.

In addition to these personal qualifications, he had also a remarkable faculty for choosing the right men and the good sense to worry them as little as possible when his choice had been made. He could, of course, not be a professional expert in all the engineering and other processes which entered into the big contracts, but he was a first-rate critic of most of them, and the records again show how carefully he scrutinized results and how quick and penetrating were his questions when difficulties arose. Except when it was necessary to take action, he kept this supervision so much to himself that some of those whom he employed were left with the impression that he was doing nothing but look on, and were surprised to discover how quick he was to spring to attention if things went wrong. His choice of men was seldom at fault, but when it was, he was firm on the point that an incompetent or unsuitable man should be got rid of quickly, even if it was necessary to pay him handsomely to go.

He was finally a shrewd and frugal financier. He seems always to have known exactly where he stood financially and what his requirements would be in the successive stages of each contract. As he gave punctual work so he expected punctual payment, and was the sworn enemy of waste or drift in any department. As the accounts came in he scrutinized them himself and made sure that no rebate due to him was overlooked. At any given moment he seemed to carry in his head not only a complete balance sheet of the firm as a whole, but the exact position and liabilities of each separate contract.

All this meant incessant hard work and a life which left little room for pleasure and sport as ordinarily understood. But to Pearson his business was sport, pleasure and adventure all in one. He was incessantly on the move, visiting his various works in different parts of England, then flying south to a railway in Spain, next to New York for the Hudson Tunnel, then to Mexico for the Grand Canal, and after that to Alexandria to see the rock-dredger at work on the mouth of the harbour. On many of these journeys his wife accompanied him, cheerfully sharing the privations of wayside inns and entering as a partner into every adventure. To Pearson in these years there was no sport equal to that of taking up a job which was thought to be impossible or winning through with a contract which seemed weighted with disaster. Undoubtedly he enjoyed the making of money, and the sense of success which goes with it, but his main pleasure was in the making of things, in seeing great undertakings grow under his hands, and in devising expedients to meet emergencies and overcome difficulties.

It is impossible to follow the stages of any of his great undertakings without becoming aware of a Pearson touch which shows his personality at work throughout. The execution is so neat ; the forethought is so elaborate ; the assembling of the parts and the timing of the various operations are so exact, and it all works out in the end so nearly as he anticipates that even the non-expert is struck with the style and artistry of the performance. Whether working out a problem in his office or seeing it solved on the spot, Pearson brought an immense zest to his work, and it was so much part of his life that he never felt the temptation to rest and be thankful. Before he was through with one big undertaking he was on with another, and the greater the burdens and liabilities he carried the happier he seemed to be.

CHAPTER IV

MEMBER FOR COLCHESTER

Pearson as Politician—Candidate for Colchester—Election for Colchester—Not a Whole-time Politician—Discontent with Parliament—" A Weary Business "—His Political Opinions—Relations with Colchester—Created a Peer.

Pearson was too deeply immersed in business to take any active interest in politics at the beginning of his career, but he was by nature and instinct a Liberal of the Gladstonian type, and in that faith he never wavered to the end of his life. In 1892, just before the General Election, a Colchester friend, Mr. Paxman, well known as the head of an important firm of mechanical engineers, approached him with a view to his contesting the seat as a Liberal candidate. His persuasions, with those of another prominent Colchester citizen, Mr. Wilson Marriage, afterwards his lifelong friend, prevailed, and thus began Pearson's long connexion with the Borough of Colchester. The 1892 election was a sporting chance, but not much more, for a popular Conservative member held the seat by a substantial majority, considering the small number of voters, and Pearson was a politically unknown young man who had only three weeks in which to woo the constituency. He failed at the first time of asking, but was judged to have done well in pulling the Conservative majority down from 291 to 61. His decision was to hold on and go at it again, and in February, 1895, when the sitting member retired from Parliament, he won a resounding victory at a by-election and got himself returned by a majority of 263. His wife shared the honours of this campaign, helping both in speech-making and canvassing, and it was said at the time that she was at least her husband's equal in electioneering. It was an entertaining and vigorous election of the old style, and came to be known locally as the " volition election," for his opponent in coming to the rescue of " the trade " against the Temperance legislation threatened by the then Liberal Government had said in his haste that " every man ought to be allowed to get drunk of his own volition." This fine old English sentiment was naturally not permitted to pass without comment on Liberal platforms. Pearson has related that the first thing he had to do on presenting himself as a candidate at Colchester was " to sit in Committee and be catechized about my treatment of labour and satisfy the Trade Unionists." He appears to have come out of this ordeal with flying colours.

Before they elected him he had told the electors quite frankly that he would probably be out of the country for several months each year, and that he had absorbing occupations which would prevent him from being a whole-time politician. They were well content to take him on these terms, thinking it ample compensation to be represented by a wealthy and influential man of business who could always be relied upon to look after their interests. He was very often absent from Parliament in the subsequent years, and to the end remained a silent member, having a constitutional reluctance to intervene except on ground on which he knew himself to be an expert. His opponents of course made the most of his absence and abstentions, and he was caricatured as being turned away from the door of the House of Commons by a policeman who had failed to recognize him. And sometimes the whips were pained, and sent polite notes drawing his attention to the fact that his attendances at division in a given session had been say 40 out of a possible 800. But one thing he did unfailingly, and that was to keep a doubtful and shaky seat through all the vicissitudes of the next fifteen years. All sorts of candidates were put up against him, including finally Mr. Worthington Evans, afterwards Secretary for War (who succeeded in getting elected after Pearson had withdrawn), but at each of the subsequent elections—July 1895, 1900 and 1906—he came back with majorities of from 200 to 300, which, considering the size of the constituency, were a larger margin of safety than might seem. Whatever other occupations he might have, he never neglected the constituency, and when he was not at hand there was always his wife to keep watch and guard.

But, as he frankly confessed, he found the House of

Commons life little to his taste. The life of Parliament is the most desultory that a man can pursue, and the condition of success in it is that he shall yield himself cheerfully and systematically to its unsystematic ways. To Pearson, accustomed as he was to allot every hour to a definite task, and to finish each day with the satisfaction of things accomplished, the necessity of being on the spot with apparently nothing to do, the wandering between House and Lobby or smoking-room and tea-room, or, worse still, the interminable listening to speeches which repeated the same arguments to audiences committed beyond conversion—all this, which makes up the life of the Parliamentarian, seemed a vexatious waste of time. After a few days of it he sat down in the corner of the Library and poured out his heart to his wife. At all events, he writes, he has had time to think, and his thoughts are all of tenderness and affection for his partner at home, and their plans and ambitions for each other, but, " Oh ! " he says, " it is a weary business for a man of business who has work waiting for him at every hour of the day." He was told that, if he would only persevere, this early malaise would go, and then he would, like other politicians, fall under the spell of the place and feel its fascination. Certainly he never wished to be out of the House of Commons, but he was always in rebellion against its time-wasting ways, and never could be what is called a good House of Commons man. Whenever business and politics conflicted, politics, unless the necessity of his vote and presence was absolutely proved, went to the wall.

Yet, outside his business and his home, politics remained to the end his chief interest in life. A genuine belief in Liberal principles kept him firmly attached to his party and made him one of its most generous supporters at a time when other men of wealth were leaving it in alarm at its advanced legislation and its supposed threats to property. He thought it just that the wealthy should be taxed in proportion to their means, and, though a capitalist among capitalists, was strong on the need of making wealth-production a more co-operative process. His experience as a business man in many parts of the world had convinced him that free-trade was, so far from being an outworn shibboleth, one of the pillars of British prosperity and a continuing practical necessity ; he

[Photo : Keturah Collings

LADY COWDRAY

was a staunch Home-ruler, one of the earliest advocates of old-age pensions and a warm supporter of the sickness and industrial insurance, which was a large part of the Liberal effort of his time. It should be added that both he and his wife were from the beginning zealous in the cause of woman suffrage, the refusal or postponement of which they regarded as a denial of right and justice, excusing, if not justifying, the militancy of women.

For the first years after he entered Parliament the Liberal party, after being heavily defeated at the polls, was threatened with further disaster by the dissensions between its Liberal Imperialists and " Little-Englanders," the followers of Lord Rosebery and Sir William Harcourt respectively, which came to a climax in the Boer war. Pearson in these days was frankly a Liberal Imperialist and follower of Lord Rosebery; and the intimacy which to the end he retained with Lord Oxford and Lord Grey, who were prominent in the same camp, began in these days. But within the party he was always a man of peace when it could be obtained without sacrificing essentials, and from the time that the free-trade cause was threatened by Mr. Chamberlain's campaign at the beginning of the new century, his influence was powerfully used for reunion and unity. He brought to politics exactly that sort of opinion and knowledge in which political leaders and whips are apt to be deficient, and very often in these years he was in the inner councils of the Liberal party, and perhaps the more so as he was not thought to be ambitious of office or in competition with those who were.

For many years 16 Carlton House Terrace was one of the chief centres of Liberal " party parties," both dinners and gatherings in the great drawing-rooms afterwards. All the famous Liberals, leaders and rank and file passed through its doors in the great days of the party, and at a time when political entertaining counted for more than it does now. There were also garden-parties at Paddockhurst, including one specially remembered at which Pearson surprised his guests, who included nearly all the Liberal members of the then House of Commons, by conveying them from the station in motor-omnibuses, then a daring novelty which most of them saw for the first time that day.

At the 1906 election, immediately his own election in Colchester was over, he went to help his son, Harold—the present Lord Cowdray—who was standing for Rutland County. Harold was defeated on that occasion, but he came in a few months later at a by-election for the Eye Division of Suffolk, and his father had the pleasure of introducing him to the House of Commons. But the 1906 Parliament was his last in the House of Commons. The next few years were perhaps the hardest and most anxious in his life. In addition to his many contracts, he was in the first years of his great oil venture in Mexico and his interests had spread all over the world. It was one thing to ask indulgence for long absences when his party was in an immense majority, but not quite the same thing when it was entering on heavy conflicts in which every vote might count and pairs be difficult to find for those who were known to be at a safe distance. So before the year 1909 was out, he decided that he would not stand again. He was strongly urged to reconsider this decision, especially by his Liberal supporters, who had serious (and, as it turned out, well-founded) doubts whether they could hold the seat with any other candidate, and not a few of his opponents, though dutifully opposing him at election time, were well content that he should be their representative. But he felt that the time had come when he must choose between business and the House of Commons, and business at that moment could not be denied.

When he ceased to be a member, the Colchester Corporation appointed him High Steward of the Borough in succession to Earl Cowper (who had recently died), and ten years later (1919) gave him the Freedom of the Borough. To the end of his life he remained on intimate and friendly terms with his old constituency, attending its Oyster Festival and subscribing generously to its movements and charities, and in 1919 he bought the ground surrounding Colchester Castle, together with the house on it, and presented it as a public park to the town. By this time memories of his hard-fought battles had softened into a general benevolence in which all parties shared, and in 1910, having been raised to the peerage with the title of Baron Cowdray of Midhurst, he entered another Assembly whose service was less exacting.

CHAPTER V

THE METHODS OF THE CONTRACTOR

A Contracting Firm and its Methods—Three Kinds of Contracts—The Specification or Bill of Quantities—Filling in the Prices and Tendering—Penalties and Bonuses—Financing a Contract—Pearson's Skill in Tendering—Time and Profit—The Importance of Synchronizing—Labour Recruitment—Wages and the Good Employer—Pearson's Faith in the Navvy—Sub-contracting.

HAVING traced the rise of the Firm under Pearson's control to the position that it occupied at the beginning of the twentieth century, I propose in subsequent chapters to select certain typical contracts and describe in detail the constructional problems that Pearson and his engineers were called upon to deal with. But for the better understanding of what follows it may be well to pause here and say something about the organization of a great contracting business.

The public in general thinks of a contractor as operating from a " yard " which contains an assortment of necessary tools and materials, picks, shovels, cranes, bricks, stone, cement, and the like, which are drawn upon for his various jobs. The Pearson Firm at a comparatively late date in its career established a depot (Stapleton Wharf on the Lower Thames), but its invariable practice was to treat each of its contracts as if it were a separate business, obtaining its own material and labour, keeping its own accounts, and in the end making up its own balance sheet. To each an agent or engineer was appointed to superintend the works on the spot, and for each a member of the Firm or Director was made primarily responsible in the London office. Pearson himself, as head of the Firm, was over all, and he seemed to know all about everything, but for the actual work he relied on division of labour and delegation of responsibility. After he had appointed a man he trusted him whole-heartedly and judged him by results. When he first came into the business, it had been the habit of contractors to wind up the services of the entire staff at the end of a contract, and to engage new staffs for each contract as it came along. Pearson from the beginning decided to retain the services of the men who had proved themselves, and brought them into the office and paid them salaries until the next job was ready for them. This was a great source of strength to him, and gave the men whom he trusted the sense that they were secure for life in the Pearson Firm.

The various contracts had, of course, the advantage of buying on the large scale which a great firm enjoys, and there was for certain purposes a central buying organization, but in general each contract was self-contained, and if, during its operations or on winding up, it passed over its material or machinery to another contract, it did so on strict business principles, and credited itself with the money realized. If a dredger, for example, was transferred from the Vera Cruz Harbour Works to the Dover Harbour Works, it was sold from the one to the other at an agreed price and accounted for accordingly by both. In general the practice was to make a clear wind-up of each job, and to sell off locally whatever machinery or material there was a market for on the spot.

Three kinds of contracts may broadly be distinguished: first, the " measure and value " contract, in which the work is laid out in detail in the specification, and the contractor names his price for each item ; second, the prime cost plus percentage for profit contract, in which the contractor charges what he spends and adds a percentage (generally 10 per cent.) for his profit ; and third, the lump sum contract, in which he undertakes all the risk, including the possibility that the design may be wrong or more expensive than he anticipates. Pearson undertook at least one considerable contract of this third type, thereby backing his faith in a particular engineer's design, but he was generally opposed to the prime cost plus percentage for profit method, on the ground that it gave no motive for economy and put the contractor under the suspicion of increasing costs in order to augment his profits. By far the greater number of his contracts were of the "measure and value" type, in which a price is assigned for each item separately, and the contractor undertakes to do the work at that price on the assumption that the specification and the quantities named in it are correct. On this assumption he contracts to do the whole work for the aggregate of the various items, but he is paid item by item at agreed intervals as the work proceeds, and if he is put to greater expense by errors in the specification or estimates of quantities, he is entitled to be paid more, unless he definitely accepts the risk of mistakes in the specification or so-called bill of quantities.

When an undertaking is contemplated, the preliminary work is done before the contractor comes on the scene. The public authority or company which desires to build a harbour or a dock or a line of railway puts its engineers on to the job, and they draw up a scheme and state how they think it should be carried out and what material employed. The general lines having thus been laid down, the quantity surveyors next get to work and estimate in detail how much of each kind of material will be needed for the different sections or parts. The specification or bill of quantities is then drawn up, and this takes the form of an elaborate analysis of the work, dividing it into different items, with the nature and quantity of the material required for each item precisely stated, and a blank space left opposite each item for the tenderer to fill in. A railway contract, for example, generally divides the work into fencing, earthworks, ballasting and metalling, permanent way, culverts and drains, tunnels, bridges, viaducts, stations and goods sheds. The section "earthworks" will show the number of cubic yards of earth to be cut away or otherwise handled for cuttings and embankments; the section "permanent way" the quantity of sleepers and rails required and the "points" to be provided; the section "bridges" will define precisely the nature of the abutments, the spans to be bridged and the material to be used. Similarly, a harbour specification will take breakwaters, sea-walls, lighthouses, quays, wharfs, etc., and set out in detail how each is to be constructed, the cubic yards of concrete blocks, and quantities of other materials that will be required, down even to the iron railings on a pier. Drawings will be provided to show not only the general plan, but the details of the work and cross-sections of different parts. The contract-form for Dover Harbour makes, with the specification or schedule of prices, a printed volume of 146 pages, and divides up the whole of this vast and intricate work into items which can be separately priced.

When this work is done, the contract is generally, though not invariably, thrown open to competition and tenders are invited by advertisement or otherwise. The contractor who desires to tender is furnished with the contract-form and specification, and, after making his own survey, proceeds to write down his prices item by item in the blank spaces left for the purpose. This is a difficult and highly expert part of his business. If his prices are too high, he may lose the contract; if they are too low, he may involve himself in loss. If it is a big undertaking, he has to estimate nicely the price at which he may be able to buy material or obtain labour over a period of years, the probable state of the money market, and, in the case of contracts abroad, the probable state of exchange, and the special risks, such as storms or other interruptions from natural causes, attaching to particular operations. He may or may not be able to protect himself from labour troubles by a "strike clause." All this, as well as his "on" or overhead charges and his profit, must enter into the price which he sets down for each part of the work.

The method will be best illustrated by extracts from a typical railway contract concluded by the Firm:

GREAT WESTERN RAILWAY

VIADUCT No. 2.

		at	£	s.	d.
3,462 cubic yds.	Excavation in foundations of piers, abutments and wing walls including all timbering and pumping .	3/-	519	6	0
1,400 ,,	Extra only to wheeling and specially punning excavation from piers round front of abutments . .	1/9	122	10	0

		at	£	s.	d.
2,268 cubic yds.	Extra only to dry stone filling over arches and backing	2/6	283	10	0
1,376	Cement concrete in foundations, including all timbering and pumping				
1,876 cubic yds.		18/-	1,688	8	0
500	Cement concrete in backing to arches, laid to proper fall				
3,100 cubic yds.	Masonry in lime mortar in piers, abutments and wing walls, below 1 ft. beneath ground level and 1 ft. beneath finished surface of new embankment	16/-	2,480	0	0
3,868 "	Masonry in lime mortar in piers, abutments and wing walls, etc., above level, including all cleaning and pointing as specified	24/-	4,641	12	0
724 "	Masonry in lime mortar in backing to arches to within 3 ft. 6 ins. of face .	16/-	579	4	0
2,480 "	Brickwork in lime mortar in arches, including centres, cleaning and pointing and all labour as specified	32/-	3,968	0	0
42 "	Ditto in relieving arches, do.	30/-	63	0	0
251 "	Brickwork in lime mortar in parapets, ditto, ditto .	32/-	401	12	0
8 "	Brickwork in cement in cesspit	40/-	16	0	0
3,600 cubic ft.	Extra on imposts measured net	2/-	360	0	0
1,554 "	Stone coping 1 ft. 9 ins. by 9 ins. in lengths of not less than 2 ft. 6 ins. set and jointed in cement .	4/-	310	16	0
1,992 sup. yds.	Asphalte $\frac{3}{4}$ in. thick over arches and backing, including best roofing felt as specified	2/6	249	0	0

			£	s.	d.
112 lin. ft.	3 in. glazed stoneware socketted pipes through arches set in cement, including cutting, building in and all bends . .	at 6d.	2	16	0
1,480 „	Extra only on blue brick label to arches 1 ft. 6 in. by 6 in. by 6 in. including all labour	1/-	74	0	0
			£15,759	14	0

TUNNEL No. 3.

				£	s.	d.
319,836 cubic yds.		Excavation for tunnel measured to back of brickwork, including all timbering, pumping and other contingencies as specified	at 8/-	127,934	8	0
26,136	70,488 cubic yds.	Brickwork in mortar in side walls, including all cleaning and pointing	31/-	109,256	8	0
37,752		Ditto in arch, including centering and all cleaning and pointing				
6,600		Brickwork in mortar in invert, including all cleaning and pointing				
10,220 cubic yds.		Excavation for ditto . .	8/-	4,088	0	0
133 lin. ft.		Blue brick label course, 1 ft. 6 in. by 6 in. by 6 in . .	2/3	14	19	3
103 „		Extra only to string course	1/-	5	3	0
288 cubic ft.		Pennant stone coping . .	4/-	57	12	0
478 cubic yds.		Masonry in mortar in facework of tunnel, including all cleaning and pointing	24/-	573	12	0
278 „		Excavation in foundations and slopes for facework of tunnel	3/-	41	14	0
48 lin. ft.		3 in. earthenware pipes in weep holes	6d.	1	4	0
50 cubic yds.		Lime concrete in foundations	15/-	37	10	0
				£242,010	10	3

It looks complicated, but it is, after all, only what a woman does when she is calculating the cost of a dress. She puts down so many yards of material, so many of lining, so many of lace and trimming, allows so much for making (labour), and, adding up the various items, estimates that the cost of the dress will be ten pounds. In the same way, adding up the items for labour and material, and making allowances on each for his own profit, the contractor concludes that the railway can be built for a million pounds.

Penalties are attached in most contracts for exceeding the time-limit, and though at first sight this may seem unfavourable to the contractor, it is actually in his interest as well as that of his employer that his liability should be thus defined. For if he were under contract to complete by a certain date and there was no agreed penalty, he would in case of failure be liable to an action for damages to which no limit would be set. There was a moment in the negotiations for the great East River Tunnels contract which the Firm undertook for the Pennsylvania Railroad Co. in New York, when the date for completion had been agreed, but no penalties assigned for non-fulfilment. Pearson and Sir Ernest Moir, who was acting for the Firm in New York, at once saw the danger of this position, and the case was met by an ingenious arrangement whereby it was agreed that if the total cost was exceeded, the excess should up to a given limit be borne in equal parts by the contractor and the employing company, but that if there was a saving, the half of that should go as a bonus to the contractor. Since economy depended on completion within the shortest possible time, the railway company thus got an effective guarantee that the work would not be delayed and the contractor was put under a strong inducement not to risk his profit or lose his bonus by prolonging it. In the event, the work was completed before the time and at a lower cost than the estimate, and the Firm did extremely well out of the arrangement.

With the specification before him, the contractor goes over the ground with his own engineer and staff before filling in his prices. When any great work was known to be pending, Pearson was often on the ground before the public authority or company had advertised for tenders, and had made up his mind what the special difficulties were and how they should be surmounted. Apart from the strictly engineering part of the work, it was essential to discover how far the necessary material and labour could be provided locally, and how far it would have to be brought in ; what space there was for shops and yards and the storage of material, and whether, if labour was brought in, housing would have to be provided for it. All these and many minor details entered into the contractor's price, and had to be carefully estimated as he prepared his bid. Finally, he had to lay his plans for the financing of the undertaking. Some contracts provided for monthly payments for work done within the month on the certificates of the employing authority's engineer ; others were so framed that the contractor had to wait for a much longer period before his first payment. In the case of Dover Harbour, the Firm spent £500,000 in the six months before its first settlement with the Admiralty. With a dozen big contracts running simultaneously, the head of the Firm had to watch carefully to see that its receipts equalled its outgoings, and, when that was not possible, to see that the necessary supplement was provided.

When work on a contract was started it was supervised by both the contractor's engineer and the employing authority or company's engineer. The latter had the right of challenging any part of it on the ground that it did not conform to specification, and if he made good his objection, to require that it should be done over again before he certified it for payment. On the other hand, the contractor had the right to claim extra payment if the specification was inaccurate or if he was put to extra expense by mistakes or errors in the estimates of quantities. The contractor might suffer from an over-estimate as well as an under-estimate of quantities ; he might have provided more material than was found necessary or incurred capital charges on the assumption that the work would last longer than it actually did. The habit into which Government departments and public authorities easily fall of leaving themselves a wide margin of error is as troublesome to the contractor as the opposite tendency of cutting estimates too fine. It was inevitable that disputes should occasionally arise, but most contracts provided for their settlement by arbitration, and the Pearson Firm very seldom found itself in litigation. Its reputation for good workmanship and its known aversion to seeking economies or making profits by skimping either material or pains were among its greatest assets; and its rule when in doubt was to give a liberal interpretation to its contract.

In the early days Pearson almost invariably did the work of preparing tenders himself, and to the end he let no tender go out without the most careful personal revision. His capacity for detail was extraordinary, and his revisions are said by those who worked with him to have been masterly. He carried the facts and figures of a dozen intricate contracts in his head at the same time, and seemed able to switch from one to another without the slightest effort or confusion. He was as skilful on the financial side of a big operation as in its engineering and technical details, and he kept a cool head in the most testing emergencies. His advice in preparing a tender was not to keep looking over your shoulder at possible competitors, but to set down squarely what the work was worth to the Firm and leave others to do it for less, if they could. On occasions he would take what he considered to be reasonable risks, but he was at all times against anything that he considered to be gambling. It would be absurd to say that he never made mistakes or lost money on any of his jobs. If some of his contracts were very profitable, others involved heavy loss or barely covered their costs. But his risks were always well spread, and his careful and scientific methods insured on the average good results.

Time is, from the contractor's point of view, of the essence of every contract. It is not merely that a penalty for exceeding time is attached to most contracts: it is that to protract the work beyond necessity is to eat into his profits. Overhead charges and labour costs run on and capital has to be provided in proportion to the time taken. On a big contract the synchronizing of the various operations, so that none shall be kept waiting because the others are behind time, is a most important part of the business, and Pearson's notes and memoranda show the pains that he took to secure this in advance. If a harbour has to be constructed, the concrete blocks for the sea-walls must be ready by the time that the staging is run out, or the great cranes will be kept idle and eating their heads off. Material for the concrete blocks may have to be fetched from a distance and light railways constructed for that purpose ; particular machinery may be required at a certain moment, and must be ordered so as to be ready at that moment ; an increased labour or labour of a special kind may be necessary at a certain point, and must be forthcoming when it is needed. Quarries may have to be bought or leased to provide stone which will be needed a year or two later. In almost any great undertaking operations starting from widely different bases have to be so timed as to converge upon a certain point at a given moment ; and all through someone must have his eye on the clock to make sure that none is getting behind its appointed date. If one contractor succeeds and another fails, it is largely because the one knows and the other does not how to keep the work speeded up and the parts assembled in a punctual and orderly way.

Much is heard in these days about the miracles of mass-production and the ingenuity shown in bringing the parts of a motor-car or a tractor to the "assembling line" at the precise moment, when it is fitted into its place by the men who handle it. But the problem of the mass factory is the relatively simple one of repeating the same operations *ad infinitum*, when once the process has been devised. The greatest ingenuity may be displayed in that, but afterwards all goes automatically and mechanically. In the contractor's assembling of his parts for a great undertaking, nothing can be relied upon to go automatically or mechanically. Unforeseen snags and obstacles may be discovered on the sea-bottom or the path of the railway ; unsuspected streams and underground rivers may break into his workings ; storms may play havoc with his time-table, and even demolish his works while they are in the initial stage. If he is working in tropical countries, he has new risks which cannot be reduced to any average : climate, tropical disease, hurricanes of a violence unknown in temperate regions.. He may secure himself against " acts of God " which for practical purposes mean earthquakes and tidal waves, but all the rest are his own risks and he must take them with a stout heart. Then in addition, and especially during and since the war, he has had the constant worry of foreign exchanges threatening confusion to all his estimates. No other business touches so many of the variable and incalculable factors of human existence as that of a contractor on the great scale.

In the Pearson Firm there was no centralized recruitment of labour. The variety and range of its operations naturally kept it in touch with all grades and kinds of labour, skilled and unskilled, and when skill and experience of a special kind were wanted, it generally knew where to find it. But each contract found its own labour, locally if possible, since that avoided the necessity of housing, but, if not, bringing it from without and providing camps and hutments. Many of the navvies, who, as a rule, formed the majority of those employed, came from Ireland, and most were of the migratory disposition which takes them where work is to be found. Pearson paid particular attention to the housing of the navvies on all his works. The married ones brought their wives with them, and were lodged in comfortable huts, which they adorned with the brass ornaments in which they took a particular pride. Drainage and water supply were carefully seen to, and a doctor and nurse appointed for each encampment. There were also Navvies' Schools and Navvies' Libraries, and the Navvies' Mission was everywhere welcome. Pearson was strong on the point that the health of his workers should be cared for, and when he came to work in tropical countries, he was one of the pioneers of tropical medicine. Whether working on the Tehuantepec Isthmus, or the Vera Cruz Harbour, or at Pará in Brazil, he had medical officers at hand and worked under strict rules, which, to a large extent, saved his employees from the ravages of malaria and yellow fever, which had proved so devastating for others in these regions about the same time.

The Firm everywhere paid the standard rate of wages, and frequently added to it bonuses and inducements for good and quick work. The records are singularly free from labour disputes ; in fact I can only find one of any consequence, the strike on the Royal Albert Dock Extension scheme in October, 1913, in which the Firm found itself involved in a dispute between opposing trade unions as to the classification of certain portions of the work. The men considered that they had no option but to come out, but as many of them had been long in the employ of the Firm, Pearson directed that on the next pay day, when no wages were payable, a notice should be issued from the pay office that while the strike lasted all men of three years' service and upwards would receive 10s. weekly for each single and 20s. for each married man. It was this kindly and sympathetic way of dealing with emergencies that accounted for his great popularity among his men. If to have employed an immense number of men over a period of nearly fifty years with so little friction and trouble entitles a man to be called a good employer, Pearson undoubtedly deserved to be so called.

He had always the highest opinion of the British and Irish navvy. Again and again he testified that he was the best worker of his kind in all the world; in other countries only the Egyptian labourer was said to come near him. The British and Irish navvy is his standard of good work when he is appraising the capacity of other workers in whatever part of the world. In some regions he is well content if he gets 50 per cent. of what a British navvy would do in the same time, and in others he estimates that an average of not more than 25 per cent. is to be expected. During a large part of the time that he employed them, many navvies were still unable to read and write. But they were not the worse workmen or the less intelligent for that. It was a saying in the Firm that "a man who isn't educated never forgets," and if he belonged to the old school of no learning, either a "standing ganger" or a "walking ganger"—i.e. a man who supervises other gangs—could safely be instructed to do twenty separate things, though he could put none of them down on paper. If an engineer asked one of these whether he had done a certain thing he had been told to do, the reproachful answer would be "Didn't you tell me?" Many of these men worked for the greater part of their lives with the Firm and followed it about from job to job. But they were aware that the best was expected of them in return for good pay and good treatment. "How long have you been with us ?" asked Pearson of one of them who was at work on a London dock. "Twenty years," was the answer. "You seem very hale and fit," said Pearson. "I have need to be," said the man, "if I have to work with *him*," pointing to the engineer in charge.

Throughout his life Pearson was warmly interested in the Navvies' Mission Society, and gave it generous support. He speaks of Mrs. Elizabeth Garnett, whose lifelong work in that field is still so well remembered, as one of his dearest friends, and after her death he was active in promoting the memorial to her which is now in Ripon Cathedral. The Aged Navvies' Pension Fund which continued its work for twenty-five years—until the State pensions rendered it unnecessary—was founded at a meeting in his house in February, 1903, and Lady Pearson was for all that time its President and Treasurer.

It may be added that in a large number of its operations the Firm was not merely contractor but promoter and partner. On the Tehuantepec railway it not only reconstructed the railway and built the ports at both ends, but ran the railway and shared the profits with the Mexican Government. In the case of the Great Northern and City Railway it promoted the company and raised the capital and ran the railway for three years. In Mexico and Chile it acquired a great many electric light, power and tram undertakings already in existence, reconstructed and developed them and worked them for its own profit. In his great oil enterprises Pearson was pioneer, prospector, producer, and distributor, working for himself and the partners and shareholders who were eventually brought in. In all these enterprises Pearson obtained the services of the best available experts and specialists, who worked for him as their "employer," just as, in his capacity of contractor, he worked for governments, municipalities and public companies as his "employers." There was often, even in his own contracts, a part of the work which he sublet to other contractors. This was specially the case with steel bridges, which his experience had taught him were best left to those who specialized in their construction.

With these explanations, the reader may be helped to understand the descriptions in detail of certain of the great works undertaken by Pearson and his Firm to which the next part of this biography is devoted. The number and magnitude of these (see Appendix I) make it impossible to select more than a few, but I have endeavoured to choose typical instances of the chief groups; and, though in nearly all there was some emergency and some expedient to meet it which would be worth recording, it may, I think, be taken for granted that the same methods were adopted in most work of the same kind. Broadly speaking, Pearson may be credited with the initiation, supervision and financing of every contract undertaken by his Firm, but it is of course always to be remembered that the carrying out of any contract is in a special degree co-operative work for which the credit in detail is widely distributed. The contractor in chief is the indispensable leader of a team, and upon him it rests to co-ordinate the different departments, assemble the different parts and ensure that the whole work is carried out efficiently and economically. But his success depends upon the wise selection of engineers and other professional specialists, each of whom is responsible for his own department and entitled to the fullest credit when it is successful. No firm was ever served by more skilful engineers and managers than the Pearson Firm found in Sir Edward Pearson, Sir Ernest Moir, Mr. J. B. Body, and Sir Frederick Hopkinson. None could have had abler and sounder legal and financial advice than it had from Sir Clarendon Hyde in the drawing up of the contracts and other multifarious business; or more careful financial supervision than was given to it by Mr. J. H. Macdonald, the Chartered Accountant who is specially in charge of its accounts. These men were not merely employees of the Firm; they were, after its conversion into a limited liability company in 1897, partners and directors, drawing a share of its profits. There were also certain others outside the Firm who contributed to its work, and especially Pearson's brother-in-law, Sir Frederick Lobnitz, Chairman of Lobnitz & Co., Renfrew, who constructed dredgers of new types and other essential machinery for harbour and dock work. Yet the management of a great contracting business is necessarily to a large extent a "one man show," as may be judged from the history of the Firm. It was Pearson who brought the Firm up to its great position from comparatively small beginnings; it was, from the necessity of the case, he who shouldered the responsibility and the liability not of one contract alone, but of all the contracts, and his handiwork may be traced in all and through all their stages. He would have been the last to claim any credit that was due to others, but the habit which grew up in these years of speaking of Pearson works and Pearson contracts was certainly well justified.

In dealing with the big typical contracts it will be convenient to depart from strict chronology and group certain of them together, while reserving for a separate section the Mexican undertakings and the search for oil in Mexico, which was the greatest of all the Firm's undertakings. The next three chapters will deal with the great tunnels.

CHAPTER VI

THE HUDSON TUNNEL

The Hudson Tunnel in New York—De Witt Haskins's Effort and the Reasons of its Failure—The Work Entrusted to Pearson—Its Difficulties and Dangers—The Shield and the Compressed-air Method—Its Effect upon Pearson and his Serious Illness—The Medical Air-Lock—Working Through Mud and Silt—The Work Suspended.

During the last years of the nineteenth century engineers and financiers were busy on the problem of bridging or tunnelling the Hudson River, and so enabling the various railway services converging on New York from the South and West to be carried forward continuously to Manhattan Island. Efficient as the ferry services might be, they were liable to interruption by fog and ice, and an alternative method of communication had become an urgent need. In the first instance the engineers turned their thoughts to bridges, for which they produced imposing designs on paper. But the enormous cost and difficulty of spanning a mile of river at the height which would have been necessary to clear its traffic put a veto on this solution, and it soon became evident that the only way was to tunnel under the river. Mr. De Witt Haskins now took the task in hand, and before the end of 1874 was ready with a complete and daring scheme for a tunnel from the foot of 15th Street in Jersey City to the foot of Morton Street in New York, with himself as engineer and contractor.

His countrymen appear to have been sceptical about the feasibility of this undertaking, and it was hampered by insufficiency of capital from the start. There were many interruptions from this cause, and several serious accidents with loss of life seemed to justify the sceptics. In 1882 the capital failed altogether, and Mr. Haskins had to abandon the enterprise. Nevertheless he had persisted most courageously in the face of great difficulties and had completed nearly 2,000 ft. of tunnel. In two respects he was a pioneer. He used the compressed-air tunnelling process for the first time in a subaqueous tunnel, and, following the example of the Tower Bridge Subway, lined his much larger tunnel with thin steel plates and bricks. But he refused to employ the " shield "—Brunel's device for protecting the workers from earth-falls and filtration of water while the permanent lining of the tunnel was being erected—and felt confident that he could do without it. This expectation was justified so long as he was working through hard material, but as soon as he reached soft silt, he began to get into difficulties. For a time he carried on by driving a small steel-lined pilot tunnel ahead of the main tunnel, and propping the steel-plate lining of the main tunnel radially from the pilot tunnel, but eventually the silt caved in, destroyed the advance workings, and buried twenty or more men. At this point the work had to be suspended and further progress seemed all but hopeless with the methods then employed.

The compressed-air process will be more conveniently described when we reach its fuller development in the Blackwall Tunnel. Suffice it to say here that the object aimed at was to raise the air-pressure to the point at which it would prevent the silt from squeezing through into the forward section of the tunnel. That was shut off by an air-tight bulkhead from the rest of the tunnel, and into the space thus enclosed, compressed air was pumped from a power-plant on the river bank. The mode of entry into this section was through an " air-lock," or steel tube built into a brick bulkhead, with air-tight doors on both sides of it, as patented by Lord Dundonald. On the door of entry being closed, the air-pressure was raised within the lock to the same pressure as that of the section beyond, and the other door was then opened. The return journey was effected in the same way, the pressure being reduced when the inside door had been closed. In the larger tunnels there were generally two such bulkheads and two regions of pressure within. The main difficulties of this method were (1) to keep the air-pressure high enough to prevent the muddy silt from squeezing into the forward part of the tunnel and yet not so high as to blow through the silt into the river above; and (2) to make it possible for men to work in this high pressure without suffering from the serious and sometimes dangerous sickness known as "caisson disease," or in American tunnel-workers' phraseology, the "bends." In all the great tunnel enterprises in which compressed air was used, these two problems were an incessant anxiety to Pearson and his engineers.

With the two thousand feet of tunnel completed it was almost certain that the work would be resumed, and a year or two after Mr. Haskins had given it up, a group of English capitalists took it in hand, with Sir John Fowler and Sir Benjamin Baker as consulting engineers. When first examining Haskins's tunnel Sir Benjamin very nearly ended his days in the "air-lock," for when he tried to get out at the end of one of his tours of inspection he found that the high-pressure air leaked round the inside door faster than the valve would let it out to the atmosphere, and it was only by smearing the inner door with Hudson silt picked up from the bottom, that he succeeded in lowering the pressure sufficiently to enable him to open the outer door.

Sir Benjamin decided that the young Pearson, who by now had a high reputation for tackling difficult jobs, was the man for this one, and on his advice the contract was let to the Firm, which took possession of the work on November 7, 1889. Mr. (afterwards Sir) Ernest Moir was transferred from Sir Benjamin Baker's staff by mutual arrangement to Messrs. Pearson's employ to take charge of the work, his special qualification being that he had had considerable experience under Sir Benjamin Baker in connexion with the sinking of large caissons under compressed air. Sir Benjamin had come to the conclusion that the completion of the tunnel was quite possible, though a difficult and dangerous job, but that it needed different methods from those employed by Haskins.

It was evident to Sir Benjamin Baker and Mr. Moir that a combination of air-pressure and shield was the only method which would enable a tunnel to be driven through the Hudson silt under a mile-wide swift-running stream. That alone would protect the workmen and make it possible to maintain the air pressure at the requisite level. Accordingly a shield was designed on Brunel's model but with special adaptations for the use of compressed air. This shield was a circular structure made of steel plates and angles with a cutting edge. It was divided in front into a series of working chambers, and provided with a diaphragm with appropriate openings covered by doors and enclosing spaces small enough to enable the very soft silt of the Hudson bed to be held back both at the top and the bottom levels with an air-pressure less than the combined pressure of the head of water in the Hudson and the mud between its bottom and the shield. In its final design the shield was divided into sections in tiers with nine working pockets. It was built in Scotland, shipped to New York, and lowered in sections into the tunnel after a certain amount of preliminary work had been done.

When Pearson took over the tunnel he found it filled with mud to the first masonry and air-lock diaphragm several hundred feet behind the working face. In fact, it was so full of entering silt that the door on the inner end of the air-lock nearest to the place where the shield had ultimately to be, and was erected, had to be pushed open by jacks to allow the then partially stiffened silt to be removed in buckets.

The job was one after Pearson's own heart. It had baffled others ; it called for pluck and inventiveness ; there was more than a spice of danger in it, and success could by no means be guaranteed. He faced the difficulties with his usual courage, and they were certainly not less than he expected. In order to erect the shield it was necessary to build an enlarged chamber at the forward end of the old tunnel with a timber-bulkhead to hold back the silt. But in spite of an air-pressure of from 35 to 37 lb. the silt forced its way in, leaving a conical cavity from the tunnel up to the bed of the river, and the more it was excavated the more it came in. The hole was easily located by a diver from the surface of the river, and was closed by means of a balloon or ball made of canvas and filled with clay, which was lowered from a floating derrick. So firmly was it wedged that when the miners cleared out the silt and got again to the head of the small pilot tunnel, which was across the tunnel diagonally, they found it projecting downwards from the roof and actually mined through it in constructing the chamber for the shield. The shield had to be transported in pieces and reconstructed in the tunnel two thousand feet from the Jersey bank, the rivets being heated in a forge with a funnel two thousand feet long leading back to the shaft, and the whole operation being carried out under an air-pressure of 35 to 37 lb. per square inch above that of the atmosphere. It is scarcely surprising that in these circumstances the already warm temperature of the compressed air was raised to 100° and higher. Working in this inferno aggravated all the difficulties of the air-pressure, and the death and sickness rate became alarmingly high.

True to his principle of not asking others to do what he was unwilling to do himself, Pearson insisted on going into the region of high air-pressure, and in December, 1890, was himself seized with the "bends" and became paralysed from the waist downwards within three-quarters of an hour of coming to the surface. He had to be taken back into the medical air-lock and treated by the process of gradual decompression devised for such cases, but even after this his condition was serious. Fortunately his wife was with him in New York, and he received the best care and nursing, but there were many moments during the next few weeks in which recovery seemed doubtful, and he suffered acute pain as his paralysed limbs returned to life. Mrs. Pearson decided that he should be moved south at the first possible moment, and while he was yet unable to walk he was carried on board a train for Mexico, and with his wife keeping watch and applying the prescribed treatment hour by hour he was well on the way to recovery by the time he reached Mexico City. But he had had a serious warning, and from that time onwards was absolutely forbidden to expose himself to any high air-pressure.

In a dejected moment during this illness he had said that the tunnel contract must be abandoned, since he could not ask his staff and workmen to face dangers which he himself could not share. Fortunately, it was found that the medical air-lock, when rightly used, virtually solved this problem, and since it is now universally in use where compressed air is used or divers descend to great depths, a word more may be said about it. The credit for this invention belongs to Mr. Moir, whose experience on the Forth Bridge, when large caissons were being sunk and some of the workers suffered from this disease, had suggested to him that the main cause of the trouble was the too rapid decompression or lowering of the air-pressure as the men passed from the working face to the surface. He found that when the decompression valves were reduced and the period of decompression lengthened there was at once a marked decrease in the number of serious cases. Following up this clue, he designed the medical air-lock, had it constructed in Jersey City and placed above ground near the shaft. It was lighted with electric light and fitted with beds, medicines and all first-aid necessaries. Men seized with the "bends" were placed in it, and the air-tight doors having been closed, the pressure was again raised to somewhere near the point at which the men had been working, and then again very gradually reduced to the normal after a short time of immersion. The effect, as an eye-witness records it, "was almost magical. Men were carried into the lock helpless with pain and partially paralysed, but as soon as the pressure was raised their troubles vanished and looks of terror and despair gave way to smiles of relief. Resting comfortably during decompression, most of them walked away cured at the end of an hour." The remedy was homœopathic. Before the patient could be cured, it was necessary for him to be re-immersed in the medium in which he had been working and then gradually brought back to the normal. The medical air-lock above ground near the shaft sufficed to save the situation for the Hudson Tunnel, and after its installation the death-rate, which at one moment had risen to 25 per cent., was reduced to 1½ per cent. per annum.

From this time forward the work went well, and over 2,000 feet of cast-iron tunnel was built at the rate of from 7 ft. 6 ins. to 10 ft. a day. The material was so plastic and fluid that it was not necessary to put men into the shield to excavate in front, the hydraulic rams being sufficiently powerful to force it through the mud and silt, which flowed in approximately at a speed ten times that of the advancing shield. After eighteen months all the mechanical difficulties had been overcome and the completion of the tunnel was merely a question of money. Unfortunately, at this point the Baring crisis came and the company paying for the work was unable to find funds to continue it. For many months Pearson maintained the air-pressure and kept the works in order at his own cost, but in the end there was nothing to do but to close down and box up the shield at the tunnel face. But so well had the work been done that, ten years later when fresh capital had been raised and the work was resumed by British engineers with American money, they found the completed part of the tunnel solid and water-tight, and were able to use the same shield, and push it through to the Manhattan shore. For ten years longer the Hudson Tunnel was still the only subaqueous passenger tunnel in New York, and in tackling the most difficult part of it the Pearson Firm might fairly claim to have done pioneer work which smoothed the path of all future constructors of subaqueous tunnels.

CHAPTER VII

THE BLACKWALL TUNNEL

The Blackwall Tunnel—Successive Schemes—Reasons for the Site—Its Problems and Difficulties—Warnings Against Tendering—The Blackwall Shield—Air-pressures and Safety Devices—The Advance Through Water-tight Clay—The Water-laden Gravel and its Difficulties—The Shield and its Shutters—A Critical Stage—An Accident in the Tunnel—Successful Completion.

Pearson's next great tunnelling contract was for the Blackwall Tunnel under the Thames, upon which work began in the year 1891. This both promised and proved to be the most formidable undertaking of the kind attempted so far in Great Britain, or, indeed, in the world. London, divided by its river, presented, though in a lesser degree, the same problem as New York; and long before the end of the last century it had become imperative to provide some better means of communication for the millions of East and South London than the ferries which plied at long intervals between bank and bank below the bridges. Bridges being ruled out on this part of the river by reason of the obstruction they would have offered to shipping, tunnelling became in London, as in New York, the only solution.

There were already in existence at this time three tunnels under the Thames: Brunel's original Thames Tunnel between Wapping and Rotherhithe, built between 1825 and 1841, and now used by the East London Railway; the small Tower Subway built in 1868, and the tunnel (or pair of tunnels) from near the Monument to Stockwell, of the City and South London Electric Railway, completed in 1890. As the experience gained in these undertakings proved, the difficulty or otherwise of tunnelling under the river depended mainly on the nature of the ground through which the tunnel had to pass. If that ground consisted of water-tight London clay, the task was relatively simple and under-water tunnelling differed little, if at all, from tunnelling through hills and mountains. But if it, or any considerable part of it, consisted of slime or water-soaked gravel, then all the ingenuity of the engineers and the best and most ingenious appliances had to be brought into play to get through without disaster in reasonable time. Brunel, who had to contend with semi-liquid slime for a considerable part of his route, was rightly judged to have performed a great feat in completing his task, with the methods that he used, in eighteen years. But the repeated irruptions of the river into his tunnel and the unending delays and difficulties that he encountered nearly broke his heart and fatally undermined his health.

After long debate Blackwall—six miles down the river from the City—was chosen as the site for the new tunnel. In view of the approaches and the convenience of the two million people who were expected to benefit by it, this decision was, no doubt, justified, but it raised all the problems of subaqueous tunnelling in their most difficult form. For a considerable part of the way the path of the projected tunnel lay through water-bearing ballast and gravel, and for one stretch of it there could be no more than five feet of this treacherous material between the top of the tunnel and the bottom of the river. These conditions could not be avoided by sinking to a lower level, since the gradients of the approaches would then have been impossible for the horse-drawn traffic which alone was contemplated in those days.[1] The level was fixed from the beginning by the necessity of a gradual approach from both ends, and the tunnel had somehow to be constructed at that level, however unpromising the material. Finally the diameter of the tunnel had to be considerably larger than that of any of its predecessors, since it was to provide for two lines of vehicular traffic as well as for a footpath on each side.

Warnings of the difficulties came to Pearson from high engineering authorities, some of whom went the length of saying that it would be his ruin if he undertook it under any ordinary contract. An eminent engineer took Mrs. Pearson aside and begged her to dissuade him from risking his reputation and his and her fortunes on this perilous enterprise. Her answer was simply: "I have the utmost confidence in Dick." The difficulties were precisely what attracted him, and he was early in the field with his bids. There were successive schemes, the first prepared by the Metropolitan Board of Works (a scheme for three tunnels, one for foot passengers and the other two for traffic each way), which was held in suspense by the Local Government Board pending the creation of the new County Council, and the final scheme (1890) for one tunnel adopted by the County Council. Pearson tendered for both, and in each case his tender was the lowest, his price to the County Council being £871,000. The specification required a roadway 16 ft. wide with two lines for vehicular traffic, and two footpaths of 3 ft. 1½ ins., the roadway to be carried on a brick arch with sufficient space below to accommodate pipes and wires. The entire length of the tunnel and its approaches was 6,200 ft., or 1 mile and 306 yards; 1,735 ft. being open approaches, 771 ft. "cut and cover," i.e. a shallow tunnel constructed in a trench and afterwards covered in, and 3,694 ft. a cast-iron-lined tunnel, of which 1,214 ft. would be actually under the river. Considering the size of the tunnel, no part of this work could be regarded as simple, and a large part of it was bound to be difficult and experimental.

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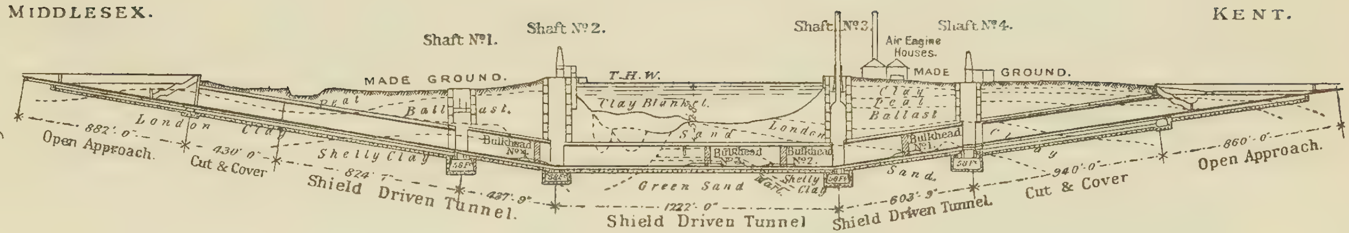
[1] A rise of one in thirty-three, or about the same as the slope on the east side of Trafalgar Square, was the maximum possible to horse-drawn traffic, but even with the steeper gradients negotiable by motor traffic it would have been impossible to escape the gravel on the Middlesex side through which the old bed of the Thames had obviously run.

Work was begun in 1891 and took six years. Sir Alexander Binnie acted as engineer for the London County Council and Mr. Moir was brought home from America and appointed engineer for the Firm. The main method adopted was again, as in the Hudson Tunnel, that of the "shield" in combination with air at high pressure whenever the entry of water was threatened. This, as already explained, had the effect of turning the section under excavation into an inflated air-cushion which automatically kept the water out. Pearson and Mr. Moir were well aware of the difficulties of this process. These were, as their Hudson experience had taught them, (1) to regulate the air-pressure in such a way as to avoid "blow-outs" and yet keep the working section dry, and (2) to enable men to live and work without risk to life or health under an air-pressure of up to 40 lb. to the square inch instead of the normal 14.7. Mr. Moir, as already related, had solved the last of these problems on the Hudson by his system of " medical air-locks " which enabled the pressure to be gradually lowered when the men came out of the high pressure region, thus avoiding the sudden deflation which, as experience proved, was one of the main causes of the illness known as the " bends." This, combined with measures for keeping the air pure, reduced the casualties to a minimum, and it is doubtful whether in the whole course of the Blackwall operations any life was lost from this cause alone. The other problem—that of maintaining the equilibrium of air-pressure—had no simple solution, and needed constant watchfulness at all times.

A little more must be said at this point about the shield and its developments during the nineteenth century for the purpose of tunnelling under the Thames. It was originally invented by the famous Brunel, who used it in its simplest form in the construction of the first Thames Tunnel. There is a story that he got the idea from watching the naval woodworm which bores into hard wood under the protection of the valvular shell with which it is covered in front. Working on the face of the shield with its hood projected like a cheese scoop into the material above, the navvy is able to excavate the material covered by this hood without running the risk of bringing the roof about his head. The shield as now used is composed of steel plating, circular in form with a cutting edge, and somewhat resembles the cap of a telescope sliding along the body when adjustments are made. The cast-iron tunnel lining behind it which forms the body of the finished work takes the place of the telescope body, and when the shield is pushed forward periodically a sufficient space is left within the thin tail on the back to enable a further ring or section of the finished cast-iron tunnel to be erected under the temporary cover thus provided. The iron so erected forms the ever-advancing tunnel, and against its end the hydraulic jacks of enormous power get their reaction to force the cutting edge into the unexcavated face. The compartments in the shield itself and the shutters used in the case of more

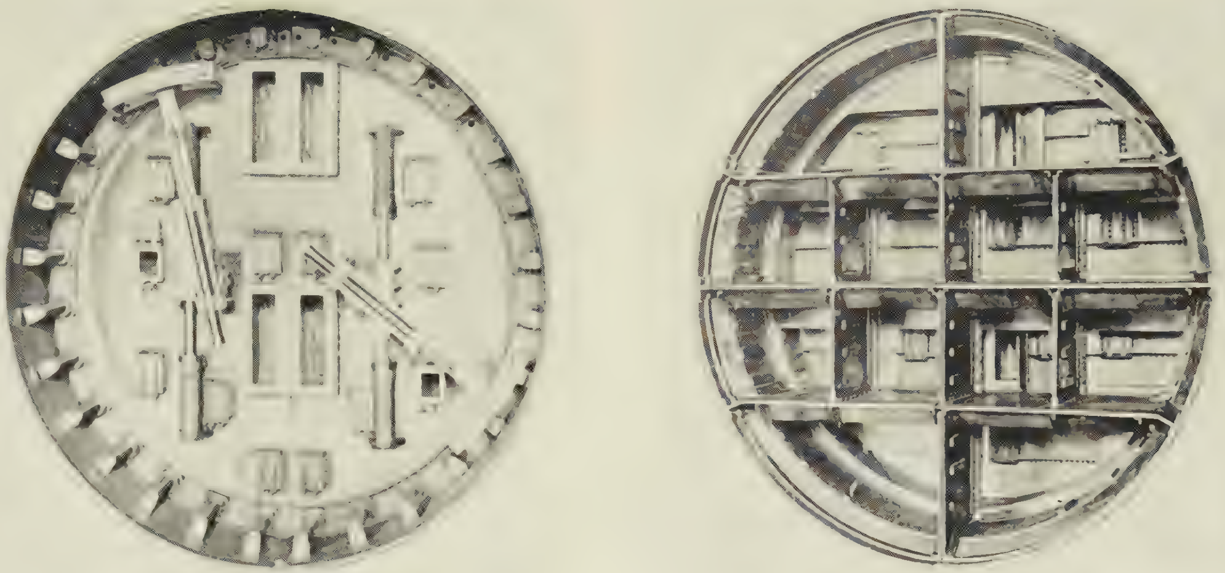
Fig. I.


MIDDLESEX.
KENT.
Shaft No. 1.
Shaft No. 2.
Shaft No. 3.
Shaft No. 4.
Air Engine Houses.
MADE GROUND.
MADE GROUND.
T.H.W.
Peat
Ballast.
Clay
Peat
Ballast
Clay Blanket.
London Clay
Sand
London
Shelly Clay
Green Sand
Shelly Clay
Sand.
Clay
Bulkhead No. 1.
Bulkhead No. 2.
Bulkhead No. 3.
Bulkhead No. 4.
882′. 0″
Open Approach.
430′. 0″
Cut & Cover
824′. 7″
Shield Driven Tunnel.
437′. 9″
1222′. 0″
Shield Driven Tunnel
603′. 9″
Shield Driven Tunnel.
940′. 0″
Cut & Cover
860′. 0″
Open Approach.

Blackwall Tunnel—Longitudinal Section

or less fluid material protect the workers in front who are doing the excavation, and those at the back erecting the iron are protected by the extended body of the shield overlapping the finished work. The shield is useful in all tunnelling, but when compressed air is used in driving through slime, fluid silt, or water-bearing gravel below the bed of a river or arm of the sea, it becomes an absolute necessity, for the air-pressure required to keep out water at the bottom is more than the fluid material above will bear, and " blow-outs " inevitably occur if there is no shield to contain the air, and even so, if great care is not exercised in modifying the pressure to meet the varying head of water-pressure.

Though the shield now universally in use is covered by the patents which Brunel took out when scheming the original Thames Tunnel, he did not use it himself, nor did he employ the compressed-air method which a few years earlier had been invented and patented by Lord Dundonald. The Brunel shield was of wood and iron, and built in sections which were moved forward separately by means of screws. An improved shield, but still on the Brunel model, was used in the construction of the small Tower Subway (1868), which marked a further development in tunnelling in that cast iron was now used for the first time to line a tunnel in place of brick; but it was not until 1886 in the construction of the City and South London Electric Railway, with its tunnel entering the Thames near London Bridge, that the shield was combined with compressed air. The engineer in charge of this work was Sir James Greathead whose name is associated with this development. Hydraulic jacks were now substituted for screws as a means of pushing forward, and the clay having been cut away in advance and excavated roughly to the shape of the shield, it was pushed forward 20 inches at a time by six of these. But the Electric Railway Tunnel—or, to speak accurately, the two tunnels constructed side by side—passed, like the Tower Subway, through a continuous bed of London clay while under the river, and the compressed air was only resorted to for a short section of gravel after the river had been crossed, and then only became necessary because pumping was barred for fear of the damage it might do to surrounding property. One important new feature introduced in this work



Back View, showing hydraulic jacks and segment erectors.

Front View.

SHIELD EMPLOYED IN MAKING BLACKWALL TUNNEL

was Sir James Greathead's ingenious device for filling the space left between the cast-iron rings and the wall of the tunnel as the shield moved forward. This was effected by forcing hydraulic lias quick-setting lime from the tank in which it was mixed under an air-pressure higher than that which was used in the rest of the tunnel.

The Blackwall shield was a development of the "Greathead shield" (as Pearson always called it), contrived by Mr. Moir from a design by Sir Benjamin Baker to meet the new and more difficult conditions. In effect it was an immense cast-iron tube weighing 250 tons, 19 ft. 9 ins. long, 27 ft. 9½ ins. in diameter, and cased on the outside with four thicknesses of ⅝ in. steel plates. Across it ran three horizontal girders with cutting edges towards the face of the tunnel, and these were divided again by one main central and two short verticals, the last two passing only from the upper to the lower horizontals. The space was thus cut up into twelve working pockets (see fig. I., p. 63) with room for two men to work in each, and being provided with a safety curtain, could immediately be closed up in case of a blow-out and inrush of water or fluid mud. Behind it were two masonry bulkheads built across the tunnel, one near the shield and the other farther back, and each was provided with air-locks on both the floor level and a level above it. Both bulkheads were brought into use when the highest air-pressures were employed, so that there were two stages of decompression for men returning from the face of the shield to the normal atmosphere. Under air-pressure the entire space between the shield and the first bulkhead was converted into a huge diving-bell, in which in case of emergency the whole working party could concentrate without fear of being drowned, and thence find their way across the gangways to the upper air-locks in the bulkhead farther back. This second bulkhead was 12 ft. 6 in. thick and was strong enough to sustain the whole difference between the normal pressure of the atmosphere and that necessary to keep a relatively dry face where the river bed was being exposed in the working in front of the shield. Except under the highest pressures this one bulkhead and its air-locks sufficed for the working parties proceeding to and coming out from the face, but two were always available.

The bulkheads were moved on as the tunnel advanced and at a given moment there might even be three in existence.

The shield being exceedingly strong and provided with 28 hydraulic jacks with a total pressure of about 4,000 tons could be pushed forward into the clay with little or no previous excavation. As the work proceeded, the permanent cast-iron lining was erected ring by ring within the tack or tail portion of the shield in the manner already described, except that the hydraulic erectors were now part of the equipment of the shield. Each ring was composed of 14 segments and a keypiece, weighing roughly a ton each, and with the aid of this ingenious machinery a complete ring weighing fifteen tons was often erected in a few minutes more than an hour. As the shield moved on, there remained an annular space between the cast-iron lining and the unlined wall, and this was filled in with hydraulic lias lime, the Greathead method already described being used for this purpose. To get this done quickly was important, not merely to provide a backing to the cast-iron lining, but to prevent air escaping from the forward compartment. At a later stage the rings themselves were reinforced by a lining of concrete on the inside and finished with the glazed tiles which are all that the public now sees.

Such was the evolution of the "Greathead shield" in the hands of Pearson and his engineer, Mr. Moir, for the purpose of the Blackwall Tunnel. Brunel's simple sectional shield had now become an immense steel apparatus, fitted with hydraulic jacks and the most elaborate mechanism for the safe and scientific use of compressed air, and joined up with an immense power station on the river bank. The initial problem when the work was started was to get this great shield, or the structural part of it, down below the river-bed and fixed in position at the required angle to the flow of the river. The tunnelling was to proceed from the Kent to the Middlesex side, and the first step was to sink a caisson shaft (No. 4 on the diagram, p. 63) by flotation down to the necessary level on the Kent side, 200 yards inland from the river. This caisson, a huge circular tank 78 ft. long and 58 ft. in diameter with an inner and outer skin and a lining of concrete between the two, sank through the clay to the desired level on the sandy bottom. The shield meanwhile was erected in a kind of dry-dock closely adjoining the caisson, and when it was finished its ends were closed with planking of four-inch deals, and the whole ballasted and kept on an even keel by two cranes attached to an overhanging girder on the top. Both caisson and dry-dock were next filled with water until the shield floated, and then it was drawn by crabs into an opening in the side of the caisson specially prepared for it, and lowered with the water as the water was pumped out. At the bottom it was landed on a formed cradle of timber and rails pointing in the direction in which it would have to go on its journey under the river. It was now separated from the river bed by the wall of the shaft, which at this point was fitted with removable plates. These plates were then removed from the bottom upwards in rows of about four feet at a time, the virgin material outside the caisson being kept in its place by bags of clay built in and backed to the shield face, which supported them until the whole of the plates were moved from the whole of the diameter and all the spaces filled with clay-filled bags. The shield was then pushed through these bags and entered the undisturbed clay without.

Before the work was finished it was necessary to sink four of these shafts, two on the Kent side and two on the Middlesex side, and the shield passed through all of them on its journey from the Kent to the Middlesex shore, each in turn being provided with removable plates to admit of its ingress and egress. When the compressed air first came into use it became necessary to construct air-locks in the working shafts. This was contrived by putting a removable air-tight floor about half-way down, strong enough to withstand the strongest pressure when loaded with twelve feet of ballast or its equivalent in water, with man-locks and material-locks passing through the water and floor and entered from a platform above it. This air-lock opened from the bottom, and the air-tight floor with the water above it formed a roof to the lower half of the shaft. When the later stages of the work were reached, and the brick bulkhead had been erected, as already described, these shaft air-locks became unnecessary. The first part of the tunnel was now in the ordinary atmosphere, and the compressed region was reached through air-locks in the bulkhead.

All went well for the first few weeks, and the shield was pushed forward 175 ft. through the clay beneath the Kent shore. Then it struck an unexpected mass of limestone rock or septaria, which turned up its bottom edge and threatened to throw it out of action. To meet this emergency a bottom heading was driven in advance of the injured cutting edge, and a concrete bed laid down on which it could slide evenly with the undamaged part. On shaft 3 (the last before the actual river bed) being reached by the advancing shield, the injured part was cut out and replaced by steel castings. This was the only serious set-back, and after two months the tunnel had been pushed forward through the water-tight clay no less than 500 ft. from the Kent shore, and more material taken out than had ever been removed from a single face in any tunnel in the same time. But the borings indicated, and the sinking of the first shaft on the Middlesex side proved, that an area of water-laden gravel and shingle lay ahead. This was struck in the roof 725 ft. from shaft No. 3, and made itself evident from the large amount of air that escaped through it from the compressed air-chamber and bubbled up into the river. Work had now to be suspended for ten days, while the working compartments of the shield were fitted with the sliding shutters which had been prepared for this emergency on the suggestion of Sir Benjamin Baker. These shutters were placed against the face of the tunnel, and controlled by a screw at each end. The method of advance was now to screw them outwards as far as they would go, the material having been removed in front, then to loosen the nuts of the screws and push the shield forward. As the shield went forward, the shutters slid back, the space in front of them being filled with gravel, which was then again removed and the shutters screwed forward again, and the operation repeated until sufficient progress had been made to allow of another 2 ft. 6 ins. ring being erected within the tail of the shield. After this it only remained to fill the space left by the thickness of the tail of the advancing shield with lime grout, for all to be taut behind.

It was at this stage that the compressed-air problem became most difficult and anxious. Large quantities of air continually escaped while the gravel was being removed from the front of the shutters, and to maintain the pressure at a level sufficient to keep the water out of the shield, but not so high as to blow out through the gravel, required a most delicate balance. For days together it was impossible to open the shutters in the upper part of the shield at all, and the material had then to be drawn out through openings in the shutters 3 ins. by 7 ins., which could immediately be closed by small sliding doors. Sir Ernest Moir relates that on opening these small doors he has often seen stones and flints churned into such a turmoil by the escaping air that sparks and fire were flying from them. Progress in these circumstances could only be slow. There was a week in which only five feet of the cast-iron tunnel was completed, and even after the men had grown used to the work and additional jack power had been provided, the standard rate was not more than 65 ft. in a month in the gravel as compared with 255 ft. while under the clay.

As the work approached the Middlesex shore, there was a stretch of 150 ft. in which the crown of the tunnel came within 5 ft. 6 ins. of the river-bed, and the material composing this 5 ft. 6 ins. was all water-soaked Thames ballast. More than ever, the pessimists predicted disaster, but Pearson and his engineers remained cool, and presently decided that if the existing river-bed would not bear tunnelling, an artificial bed must be provided for the purpose. They accordingly fetched large quantities of clay from the mouth of the Medway and dumped it from the surface of the river in the form of a blanket, 150 ft. wide and 15 ft. thick, covering this part of the bed. Frequently, for days together, the top of the shield was driven through the clay thus artificially provided, the natural bed being at the same time removed below. The clay having served its purpose at one point was dredged up and re-deposited further ahead, where it did duty a second or a third time until the danger zone was passed, and the cast-iron lining with its backing of hydraulic lime was securely in position and completely water-tight. During this period the problem of air-pressure was more than ever difficult. On the one hand, the artificial clay bed was liable to be blown off if the pressure at the top of the shield was more than was necessary to balance the pressure from above; on the other, the vertical diameter of the tunnel was such that this balancing point was generally 13 lb. per square inch lower than was necessary to keep the bottom dry. Of the two evils, the flooding out at the bottom had to be accepted and a large inflow of water dealt with by pumping. Exact calculation of the head of water at different states of the tide and of the pressure required to meet it, was a constant difficulty, since allowance had to be made for the displacement of the water by the escaping air, and the lowering of the weight of water through mixture with air-bubbles.

The methods adopted sufficed, but Pearson would not have been beaten if they had failed. With his usual foresight, he had contemplated the possibility of failure, and in that event, was prepared, as he told his engineer, to carry out the tunnel by means of coffer-dams stretching half-way across the river at different periods of construction. If that necessity was avoided, and the tunnel completed without disaster, it was only by the utmost skill and care and resourcefulness in emergencies. There were blow-outs on two occasions[1] when the workings became one-third full of water in a few minutes. But at these moments the situation was saved by the precautions taken in advance, and what might have been serious catastrophes attended with considerable loss of life proved to be no more than untoward but remediable incidents. In 1895 the water broke in just after the top shutters of the upper part of the shield had been advanced, and what happened next is thus described in a report made for the London County Council:

> The men working at the face of the shield at once closed the doors of the two top compartments in the shield, and retreated under the hanging screen to the air-lock, and all of them went out with the exception of the foreman and seven leading men. The clay deposited

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[1] On one of these occasions it was reported that a man's waistcoat was blown through the roof and fished out of the river with a sixpenny-bit still in the pocket.

> on the bed of the river sank down into the shield pockets, which checked the inrush of water and ballast. This, together with the reduction of air-space occasioned by the rising of the water, soon enabled the engines to increase the air-pressure from 18½ lb. to 20 lb., and to stop the inrush of water. The remaining men then clambered back to the face of the shield along the gangways prepared for this purpose (there being from 3 to 4 feet of water above the road), and closed the two other doors and the doors of the evacuation shoots—the latter they had previously been unable to shut owing to the inflow of water. After the men had accomplished this, and had raised the nozzles of the blow-out pipes from the sand and gravel which had blocked them, a second interruption took place on account of the air-pressure again rising above that balancing the head of water. With some difficulty, however, owing to the fog caused by the reduction of air-pressure, the men once more made their way back to the locks along the gangways and pipes. The working face having been made air-tight, no further trouble was experienced in keeping up the air-pressure and in driving the water back, and the work of clearing out the debris was proceeded with by the new gang which came on at 6 a.m. The irruption seems to have been due to a cavity which had formed in front by the ballast running into the shield from underneath the super-incumbent clay which had been dumped in the river, and was no doubt held up by the air-pressure until the latter fell in consequence of a small " blow-out " and the Thames broke through the bed of the river.

The official report makes no comment, but for an example of coolness, resourcefulness and intrepidity in an emergency, this plain tale would be hard to beat. But these possible misadventures had been foreseen and the method of dealing with them provided from the beginning.

Visitors who were invited to inspect the Tunnel in its last stages have recorded some of their impressions. Entering the air-lock, as by the door of a safe, some felt sharp pains and throbbings in their ears as the pressure was raised by the air which came rushing into the lock. The drums of their ears were pressed in from the outside and the Eustachian tubes did not operate, but obeying the instruction to blow their noses and swallow, and so transfer the air-pressure to the throat and back of the ear drums, they quickly got relief. Then they felt a great exhilaration as if they had drunk a bottle of champagne. They were impressed by the " weirdness of the subterranean air-bubble in which they found themselves—black darkness all round save for the line of electric lights running along the roofs, men with pink candles working in crannies, a strangely death-like chill, a touch of clamminess in feeling everything, voices piping shrill and strange and ghostly." One visitor reflects that " the whole thing hangs on the precision of a brain on the bank of a river three-quarters of a mile away, for had the engineer there failed, the compressed air would have vanished, and the tunnel would have been flooded, and the electric light would have gone out. In fact every living soul in the vast gloomy chamber was in the keeping and at the mercy of the brain on the bank " and the devices already prepared for safety. Others comment on the admirable precautions for the health and safety of the men—the medical officer appointed by the Bridges Committee of the L.C.C. always on the spot, the cooling and purifying of the compressed air, the covered passage to the bank, and the dry clothes provided for the men when they came up. The new County Council prided itself on being a model employer, and found Pearson always in the heartiest co-operation on this side of the work.

The Tunnel was ready for traffic by the beginning of May, 1897, and on the 22nd of the month was inaugurated by the Prince of Wales (afterwards King Edward), who drove through it in state from the Poplar or Blackwall entrance to a flourish of trumpets and salvo of guns. The Prince in his speech described it as a triumph of " engineering skill and civic spirit," and dwelt on the happy fact that so few accidents had attended the work, and that such solicitude had been shown for the workmen. Pearson insisted that his father, who was still the nominal head of the firm, and not himself, should be presented to the Prince on this occasion, for, as he said, it might be "his last opportunity."

Another London undertaking which followed quickly on the completion of the Blackwall Tunnel, was the Great Northern and City Railway, begun in the year 1898. This is a leading example of the undertakings mentioned in a previous chapter in which the Firm acted as promoter as well as contractor. Its object was to remove the difficulty which then existed of getting from the north to the City and Bank by constructing a tunnel railway from Finsbury Park to Finsbury Pavement, a distance of three and a half miles. At Finsbury Park there was to be a connexion by lifts and passages with the Great Northern Railway, and with the Piccadilly Tube, and at Old Street, one of the intermediate stations between Finsbury Park and the City, with the City and South London station, whence there would be through communication to the Bank and south of the Thames. Authority was taken later to build an extension from Finsbury Pavement to Lothbury, close to the Bank, which though only a quarter of a mile long, was an important link for traffic to the centre of the City. The Great Northern was also expected, when the new railway was finished, to join it up by another short section with its own system.

The scheme was not a new one, but a previous attempt to obtain public support for it had failed. Pearson, nevertheless, thought it thoroughly sound, and decided to float a company with a capital of £2,000,000 to carry it out. This time the public subscribed freely, and the Firm itself was a large investor and undertook the whole of the work, giving the direction of it to Sir Ernest Moir, with Mr. B. Everett acting as engineer. Since the route lay through London clay and no water was encountered, the work was straightforward, but there were several interesting new features in it. The original intention being that the Great Northern should run its trains through them, the tunnels had to be much larger than ordinary tubes, and correspondingly larger openings had to be provided at the stations. For this reason the shields had to be larger than any hitherto used, and were constructed in six sections and put together at the bottom of the shaft. From first to last six shields were brought into use, two working north and two working south, and a third pair being added to save time on the southward journey after Old Street Station had been reached. The stations presented a special problem for the shields, and special shields of still larger size through which the smaller shields could pass had to be provided at two of the stations. Another speciality of this railway was that the lining of the tunnels was of a composite character, the top half being of the usual cast-iron and the bottom half of brick. The object of this was to minimize noise and vibration, and the result was said to be completely satisfactory.

The Firm not only completed but worked the line successfully for three years. Then it was sold to the Metropolitan Company, and it now forms an important link in their system and by its connexion with the City and South London Railway at Old Street enables the passenger from the north to continue his journey to London Bridge, Kennington and Clapham. The business had not been unprofitable, but in one respect it had disappointed Pearson, for the connexion with the Great Northern system on which he had relied and for which the tunnels had been specially constructed was not effected.

CHAPTER VIII

THE EAST RIVER TUNNELS

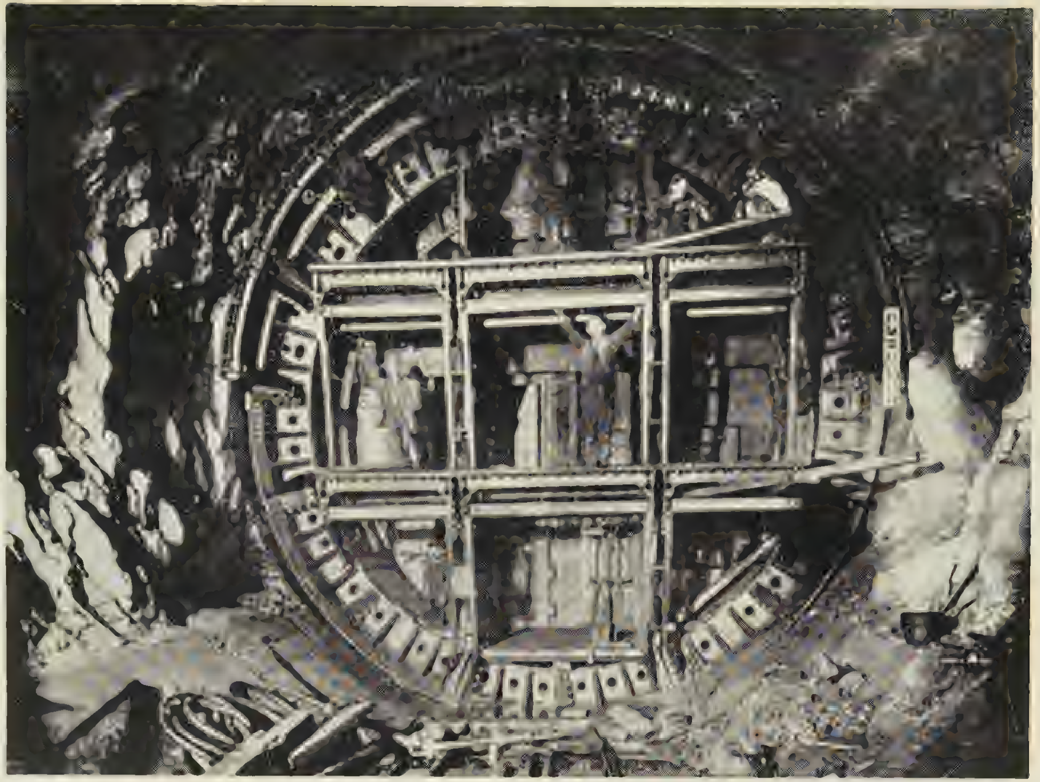
The East River Tunnels in New York—British Engineers and American Coadjutors—A Special Feature of the Contract—The East River Problem—Its Difficulties—Danger of Fire—The Four Tunnels—Working from Both Ends—Drilling through Rock—Compressed Air and Quicksands—Blow-outs and American Comments—An American Tribute—An Incident at a Dinner-party.

Pearson happened to be in New York on his way from Mexico in April, 1903, when the Pennsylvania Railroad Co. was about to invite tenders for four tunnels under the East River to connect the Long Island Railway system with their own system in Manhattan. He was very far from well at the time, but hearing of the scheme, he recognized it at once as one of his opportunities, and, in spite of doctor's orders, spent many feverish hours in exploring the problem and obtaining the material necessary for attacking it. He went thoroughly into the matter with his engineers in the autumn and winter of 1903, but in 1904 when the tender was about to be sent in he had to undergo an operation for gall-stones in his own house at Paddockhurst, and for some weeks was unable to attend to any business. But he had worked at the tender up to the last moment before the operation, and Mr. Moir was now on the spot in New York and in touch with the Firm at home, which knew their Chief's views sufficiently to enable the contract to be completed without any serious departure from them.

The problem was one after his own heart. It was difficult, it might be dangerous, there was in it a large element of the incalculable and unforeseeable. It was described at the time as the "greatest engineering work of the kind ever undertaken," and, so far as subaqueous tunnels are concerned, it may fairly be said to hold that title up to the present time. Pearson had behind him the prestige won in his earlier work on the Hudson Tunnel. It was evident that if any man could do this work it was he, and when it came to tendering he was without serious rivals, British or American. There were murmurs in patriotic circles at the choice of a British firm for this great American job, and Pearson knew from the beginning that watchful eyes would be upon him. But this, so far from discouraging him, added zest to the undertaking. He felt the credit of British engineers and contractors to be in his hands.

For the purposes of this undertaking it became necessary to form a special American company, S. Pearson & Son, Incorporated, with its own capital under United States law. This company had its own board of directors, which included Mr. Lewis L. Clarke and Mr. G. W. Wickersham and Mr. Henry W. Taft, both of whom were intimate friends of Pearson, and his legal advisers in New York. The American Press was often hostile—one paper even went to the length of accusing the company of burying men in the tunnel to escape the disclosures of an inquest—but the American coadjutors were always helpful and sympathetic, and Pearson and Mr. Moir, who took charge in New York, worked throughout on the friendliest terms with the Pennsylvania Railroad Co. and its officials and staff, especially Mr. A. J. Cassatt, Mr. Samuel Rea and Mr. Alfred Noble, the Chief Engineer. Sir Benjamin Baker, too, was always at hand with advice and counsel at difficult moments. From first to last the work was carried out in a spirit of comradeship and mutual understanding between British and American engineers and experts, who brought their united wits to bear on an enterprise which all regarded as a common cause.

The special feature of the contract, which was based on a cost plus percentage arrangement as a primary payment, was the proviso that if the actual cost was less than the estimate based on the original scheme or that scheme corrected by subsequent modifications, the contractor was to get 50 per cent. of the saving; but, on the other hand, if the cost exceeded that estimate he was to be mulcted in 50 per cent. of the excess up to a limit of a million dollars. Since the



FRONT VIEW OF SHIELD, EAST RIVER TUNNEL

contract was for eighteen million dollars, and the work was known to be difficult and even dangerous, the acceptance of conditions which might easily have wiped out the whole of his profit was judged to be a very spirited act. But Pearson never hesitated to back himself, when he had thoroughly prepared the ground, and the arrangement turned out greatly to his advantage.

The East River problem differed materially from that of the Hudson River and of the Thames at Blackwall. In the Hudson the material to be dealt with was soft silt and at Blackwall it was Thames gravel. In Manhattan it was rock, but unfortunately of a treacherous and varying character. Some of it was a compound of rock and quicksand—a condition never met with by the Firm in any other tunnel elsewhere—and extremely difficult to deal with; and some was decomposed schist which could only be blasted at the risk of letting the water in from above. Whichever it was, it required a different method of working from that employed in either the Hudson or the Blackwall Tunnel. In the Hudson Tunnel it was never possible, and in the Blackwall Tunnel never necessary, to get outside the shield, whereas in the East River Tunnel it was always essential. The shield could not be pushed into rock without a pressure which no shield could have withstood, and it was therefore necessary to bore and blast (when blasting was possible) in an open space in front of it. When the first advance was made on the Manhattan side, Mr. Moir went in alone with one miner and poled all round with timber in the fine running sand, so as to enable the top of the rock to be attacked in the only practicable way, i.e. from its surface after the quicksand had been removed. Only in this way could a bed be prepared in which the shield could slide forward.

This method of working, when compressed air was employed, entailed a risk which one would suppose to be very remote from the construction of a cast-iron tunnel through wet schist and quicksand, the risk, namely, of fire. A queer but logical sequence of events led up to that result. In the space outside the cast-iron tunnel it became necessary to timber all round to a larger diameter than the shield, so that when the latter came forward it should not disturb the timber.

But when the shield had passed, this timber being unsupported got displaced and let a large amount of air escape through it and through the cracks caused by its settlement. Then it became necessary to find and stop these leaks with smears of clay, and the method adopted was to apply the flame of a candle, which immediately showed where the air was escaping. But on more than one occasion the blast caused by the escaping air set fire to the timber, which quickly became a roaring furnace for many feet behind the shield and the fixed cast-iron lining, and it was only by blowing in water and lime under pressure that the flames could be stifled. More than once the cast-iron lining became red hot.

In such conditions the shields needed to be of a special design and the technique differed materially from that employed in the other tunnels. But except for the land tunnels under Long Island, which passed through solid rock and were largely constructed in the open air, the combination of the shield and compressed air was employed in all and presented the same problems as had been faced and met in the other tunnels.

The scheme provided for four tunnels, each 23 ft. in diameter, or 4 ft. less than the Blackwall Tunnel, which were to cross the East River in an almost straight line from a terminal between Thirty-third and Thirty-fourth streets at First Avenue, to Thomson Avenue in Long Island, and to be continued for 2,000 ft. inland to the East Avenue in Long Island City. The Manhattan terminal had also to be connected with the main terminal in Seventh Avenue—now the great Pennsylvanian Railway Station—by a tunnel running parallel to Thirty-third street. The length of the four tunnels was 24,704 lineal feet. In this undertaking it was possible to work from both sides of the river and join up the tubes under mid-stream. From Manhattan four tubes of 2,000 ft. each were driven eastward under the river ; and from Long Island four tubes of 2,000 ft. each westward under the river ; and simultaneously the four tubes under the land in Long Island were started westward from East Avenue towards the Long Island shafts. The plant which had to be provided was enormous. The four tunnels starting from each side under the river required eight shields ; and power houses to supply compressed air had to be erected on both the Manhattan and the Long Island shores. The combined capacity of the plants was 80,000 cubic feet of air per minute; and on each side of the river were three hydraulic pumps, all capable of compressing up to 6,000 lb. per square inch, to push the shields and erect the cast-iron lining.

The shields were lowered into caisson shafts fitted at the bottom on the side facing the river-bed with movable plates, which could be taken out and passed back through the shield when it was in position. On the Long Island site the caisson had to be sunk under air-pressure, the cutting edge being carried on blocking while the rock was blasted out from under. When the caisson had been sunk to a depth of 90 ft. the air-tight floor was removed, the shield lowered and built in position, and the floor again put on at a higher level above the shield. Then the air-pressure having been turned on, and the movable plates facing the river-bed in the caisson removed, the shield was ready to start on its journey. Later, when the necessary bulkhead and air-locks had been installed in the extending tunnel, the air-tight floors were removed from the caisson shafts. On the Manhattan side, where the ground was rocky, the caissons were sunk without air and stopped after about 40 ft., and the shaft continued in the open without steel-work. The shield was then lowered and built on wooden cradles, and when finished, pushed into the tunnel, which had been driven as far forward as the rock permitted. Finally the bulkheads with their air-locks were built up behind the shield, and the air having been pumped in between the bulkheads of the face, all was ready to break through the rock into the soft ground beyond.

Though drilling through rock was necessarily slow—about 15 ft. of completed tunnel per week, as compared with 75 ft. through soft material—it presented no special difficulties to expert tunnellers. The real difficulties in the East River as in Blackwall were with the soft material, and once more the old dilemma presented itself. If the air-pressure was raised high enough to dry the quicksand at the bottom and prevent the shield sinking, the roof was blown off, and if the pressure was kept low enough to keep the roof safe, the shield sank into the quicksand, which ran into the workings. Once more the remedy which had proved successful at Blackwall was tried, and 500,000 cubic yards of clay dredged from the Hudson near Havershaw was dumped in the East River in the path of the tunnel.

This, combined with the use of quick-setting cement or lime grout for stopping blow-holes, proved efficacious in the long run, but " blows " were much more frequent than at Blackwall. The material varied from hard rock to disintegrated or seamed rock and silt, and it was difficult to calculate precisely what pressure it would stand. Shutters were tried in the eastward borings, as at Blackwall, but it proved impossible to keep them in close contact with the face, the face being generally some feet in advance of the shutters, with the result that the air escaped freely and caused " blows." The shutters were therefore abandoned and excavation carried on by poling the top and breasting the face. In the deepest part of the river there were only fifteen feet of quicksand cover between the tops of the tunnels and the 62 ft. of tidal water backed by the Atlantic above. In actual measurement this was 10 ft. 6 ins. more than in the worst piece at Blackwall, but the material above was even more treacherous, and by the time the shield went through it, after the clay dumped from above had taken the place of the quicksand removed within the shield, there was nothing to spare. There were moments when the future looked dark, and Americans began to say that the British engineers were beaten. One of the shields sank 9 ins. below grade into the sand at a spot near the Ferry Docks on the New York side, where a large number of piles had been removed in order to turn what had been a series of ports or " slips " for three ferries into slips for four. This involved the removal of all the piles from the three-slip system and their replacement with piles for the four-slip system. These operations not only opened and loosened the riverbed, but prevented an effective dumping of clay for holding the air. The material above having been thus weakened, the air-pressure necessary to dry the face proved too much for it and the tunnels were several times flooded. Then there was nothing to do but bulkhead the face and shut down the works for three weeks to give the river-bed time to settle down. Then a fresh start was made after more clay had been dumped from above.

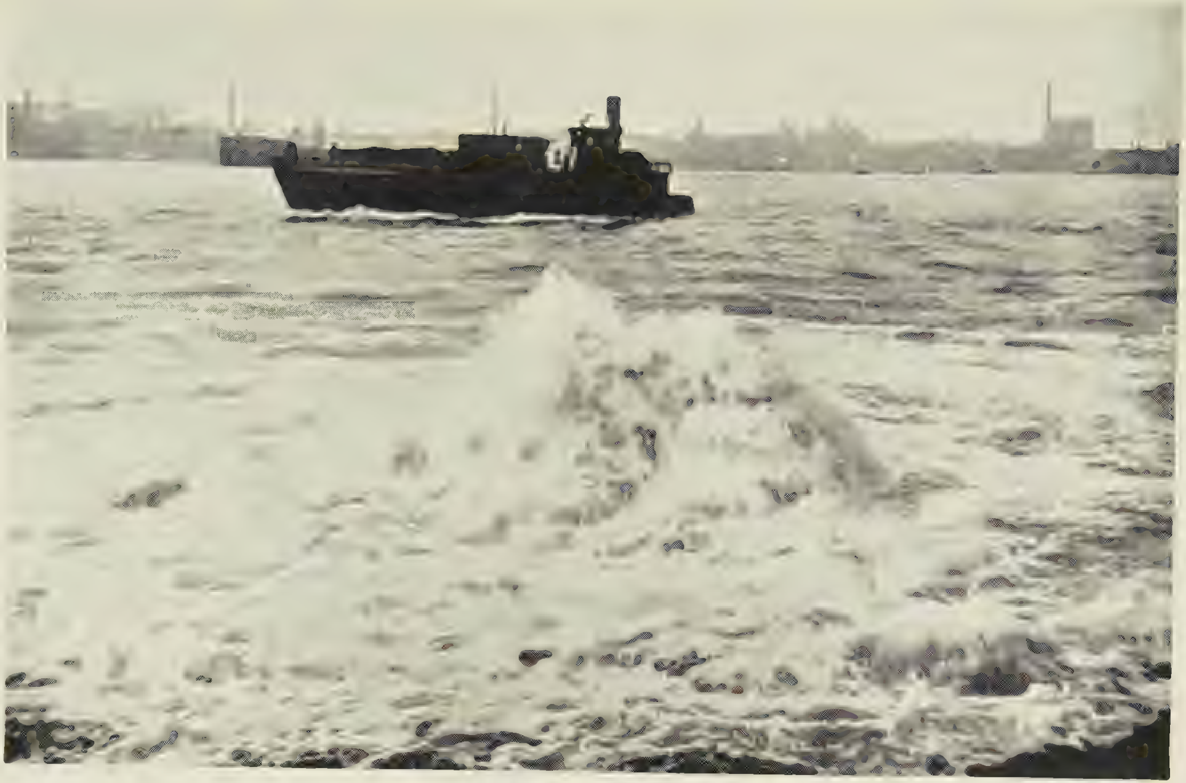
Sir Henry (then Mr. Henry) Japp, who took charge for the Firm in Mr. Moir's absence, has some lively recollections of these times. During an extensive " blow-out " in a tunnel under construction for the Inter-Borough Rapid Transit Company, one of the workmen was forced through a break in the bed of the river by a rush of compressed air. He was rescued on the surface unharmed, and if he received any damage it was only from his too frequent entertainment by his admirers and the local saloon-keeper. A mishap of a different kind befell one of Pearson's employees. One day the outside foreman on going up from the shaft looked in vain for his mule-driver. Finally, after much search, he discovered that the doctor in attendance had put him into the medical air-lock under air-pressure. It turned out that he had been kicked in the stomach by his mule, and had been taken to the doctor's office suffering great pain. As he could speak no English and was holding his stomach and groaning, the doctor concluded that he must be a case of " bends," i.e. caisson disease, in the stomach, and immediately bundled him into the air-lock. The treatment proved thoroughly effective, for on emerging, rather than face another dose of this remedy, he declared himself absolutely cured.

The " blow-outs " were on a formidable scale, as much as 18,000 cubic ft. of compressed air per minute frequently escaping from one tunnel. The rush of this large volume of air through the doorways in the shield at the tunnel-face was so strong that it impeded the men from passing through the openings. An Italian refused to return to the tunnel on the ground that when he endeavoured to get out, " a devil pulled him back all the time," and tried to persuade his fellow workmen that " there were strong devils in the tunnel trying to kill them."

At a certain stage in these operations it was proposed to freeze the quicksand as the best way of getting through the most difficult part, and Sir Henry Japp recalls how Pearson astonished the engineers by producing calculations to prove that this method could not be successful. His prediction was subsequently borne out by the experience of the Pennsylvania Railroad Co., which, after spending considerable sums of money on the freezing process, found it to be a failure. In the meantime, while this experiment was going on, the Pearson Firm continued doggedly driving their four 23-ft. diameter tunnels through the same quicksand. In the end the New York newspapers were unstinted in their praise of the persistent Englishman who, as they put it, had continued " sawing wood and saying nothing " and had completed the East River Tunnels before any other part of the great Pennsylvanian Railroad project had been finished.

But in the meantime embarrassing publicity attended some of these emergencies. The blow-outs made much commotion on the surface of the river, which was thronged with tugs and ferry-boats continually arriving at and departing from the slips. The owners of these did not conceal their alarm or their intention of seeking compensation for the loss and damage which they declared themselves to have sustained. The *New York Herald* printed a highly-coloured account of some of these happenings, in which it spoke of " the boiling flood which had churned the waters, sending foam high in the air and setting the tide racing like a mountain torrent." It described how the roof of one tunnel had blown up, throwing rock and mud fifty feet into the air, and threatening to tear out the adjoining wharf, how the contractors were dumping scow-load after scow-load of red clay in a vain effort to stop the holes, and how the compressed air was blowing the clay out as fast as it was dumped. To go on, said the newspaper, seemed useless, and yet to shut down for an instant would be to permit an inrush of water which would do incalculable damage.

Shutting down had never entered the heads of Pearson or his engineers, who, thanks to the experience they had gained on the Hudson River and Blackwall Tunnels, knew what measures to take in these emergencies. Nevertheless, it had been a difficult, at times a dangerous, and always an anxious job, and it was a great relief to them when, on March 18, 1908—three years and six months from the sinking of the first shaft—the last of the tubes was joined up under midstream. Engineers were agreed that the quartet of tubes



BLOW OUT IN THE EAST RIVER, NEW YORK

had presented the most serious difficulties that had so far been encountered in subaqueous tunnelling, and the *Wall Street Journal* wrote handsomely of the British achievement:

> It is perhaps a little bit hard on the pride of Americans in their self-asserted leadership in "enterprise" that the greatest engineering undertaking in the history of this country is being carried out by a firm of Englishmen. Still more strangely, they did not find it necessary to call upon Americans to any considerable extent in making up their engineering staff. A Reporter for the *Wall Street Journal* who went through the last two tunnels to be pierced through, found himself surrounded by Scotch and English engineers. Several hours' association with these men was enough to sweep out of the reporter's mind the last vestige of whatever mistaken notion he may have had that the Britons were less gifted with ardor for practical daring than his own countrymen.

Pearson came out of the affair handsomely and profitably both for himself and for his employer, the Pennsylvania Railroad Co. He and his firm were also judged to have dealt wisely and fairly with labour and other problems which might have presented difficulties to men less tactful or less familiar with American conditions. To Pearson himself, it was a special satisfaction to have completed the work in good time and to have turned to profitable account his sporting offer to share either excess or saving in the estimated cost.

Some years later, at a London dinner-party, he found himself sitting next to an American lady, who improved the occasion by enlarging on the superiority of American engineers over all others and mentioned the East River Tunnels as a crowning example of their skill and enterprise. Pearson gravely promised her that he would not omit to visit them and examine them carefully when he was next in New York.

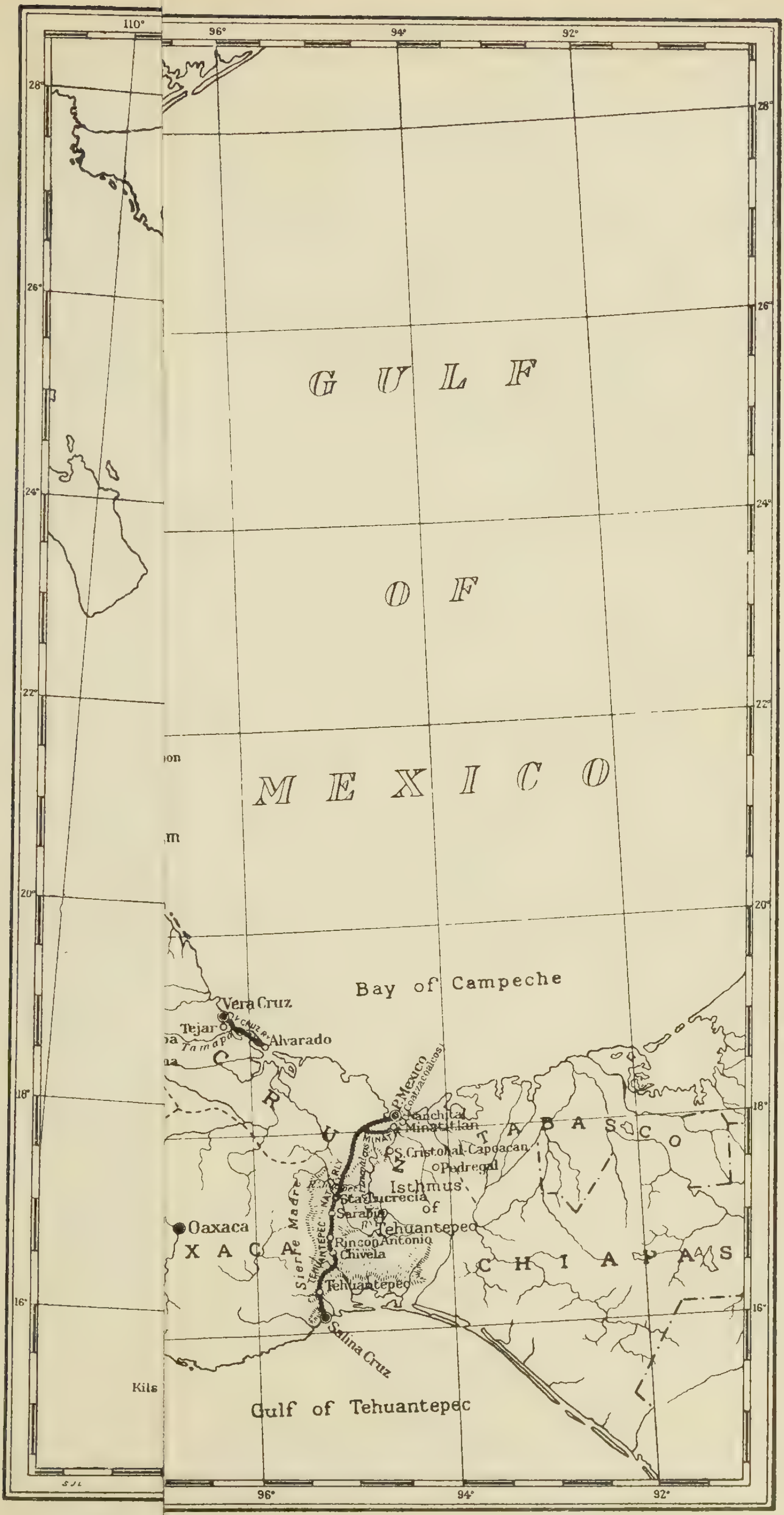
CHAPTER IX

THE MEXICAN GRAND CANAL

First Visit to Mexico—A Holiday and Business—The Mexican Grand Canal—Negotiating a Contract—The Drainage Problem—Its History and Difficulties—Preparing a Scheme—Designing a Dredger—Intimacy with Diaz—A Diaz Incident—Some Reminiscences—An Eleven-hour Day.

After his spell of hard and perilous work on the Hudson Tunnel in October and November, 1889, Pearson had greatly desired to get home before Christmas. But the Firm were at that moment preparing their tender for the Nile dam (at Assuan) and it became imperative for him to remain in cable communication with the London office for the revision of the last figures. Since wireless on board ship was still in the future, this meant staying in New York. So far as the Nile dam was concerned, the effort was wasted, for the contract went to Sir John Aird, but it had a highly important sequel. When at length he was free to return, Pearson found that he could get no return passage which would bring him back before Christmas. So having to stay, he proposed to his wife that they should get out of the frost and snow of New York and take a trip to Mexico on the new train—the Montezuma Express—which was then being widely advertised as an easy way to the "sunny south." His wife warmly approved, and they started together in the second week of December.

This is how the thing actually happened, but Pearson's holidays often had a motive, and it was no doubt in his mind when he started south from New York that Mexico was a land of opportunity for the contractor and engineer. A Mexican official sent by President Diaz had come to him in New York to beg him to consider the contract for the


GULF OF MEXICO
Bay of Campeche
Gulf of Tehuantepec
Vera Cruz
V. Cruz Ry.
Tejar
Alvarado
Tamapa
Oaxaca
P. Mexico
(Coatzacoalcos)
Nanchital
Minatitlan
S. Cristobal-Capoacan
Padregal
Isthmus of Tehuantepec
Sta. Lucrecia
Sarabia
Rincon Antonio
Chivela
Tehuantepec
Salina Cruz
Tehuantepec Nat. Rly
Minat.
Sierra Madre
VERA CRUZ
OAXACA
TABASCO
CHIAPAS
Kils
110°
96°
94°
92°
28°
26°
24°
22°
20°
18°
16°

Grand Canal which had been before him in London earlier in the year, but which he had then been disinclined to accept. He seems to have concluded that as the opportunity offered, it was worth looking into. In certain notes dictated shortly before his death he records simply that he " went forward to Mexico in December, 1889, to negotiate with the Government for the construction of the Grand Canal that was to drain the valley in order to prevent the city being more or less regularly flooded during the wet season." At all events he had no sooner arrived in Mexico City than he found himself plunged into the affair of the Grand Canal and on the way to conclude a contract with the Commission to which the Government had deputed the work. In the same notes he adds some details which show the rapidity and decision with which he brought the Mexicans to the point :

> I allowed myself ten days in which to settle and sign the contract. It was soon apparent that our meetings in the morning would not enable the discussion to be completed within the time limit, so I persuaded the Commission to meet in the afternoon also. Again time was gaining on us, so we discussed in the evening, and finally settled all matters except two or three about which we could not agree, and which had to be referred to the President for his decision.
>
> That President was General Diaz. After explaining my views and requirements through an interpreter, I left the room for the Commissioners to discuss the matter with the President. After a time I was summoned back to the Conference and pointedly asked if the Commission understood aright that I declined the contract unless three points on which I was insisting were conceded.
>
> The question was put in such a way that I had either to give way or lose the contract. As I could not give way I told the President that I was full of disappointment at what I thought was the non-success of my negotiations ; but to my surprise—certainly it was to my surprise after the way the question had been put—the President said : " Well, if you won't give

> way, the Government will, provided you assure me on your honour that you will always treat the Government in the same way that you would expect to be treated by them, had they been in the saddle as they ought to be, instead of putting you there." I gave the promise without hesitation, and from the day the contract was made no question ever arose between us as to its fair interpretation.
>
> It had been the usual practice for the Government to make a one-sided contract, in its own favour of course, and then for the contractor to be a suppliant to get its conditions modified or made workable. It was an unknown thing to the Mexican Government to have a would-be contractor stipulating for a fair, clearly defined and workable contract and for the contractor to abide rigidly by all the terms of his obligations without any desire to recall or better them. When I next saw the President, twelve months later, he was visiting the work to see what we were doing, and he shook his finger at me with a smile and told me not to forget the personal arrangement that existed between him and me.

Such was the beginning of the long and fruitful association between Pearson and the famous President of the Mexican Republic. Pearson admits to have been a " little tired " after this pleasure jaunt and slightly disappointed to discover on his arrival home that he had " not yet clearly formulated in his own mind the methods for carrying out the contract." It is reasonable to surmise that the Mexican Commissioners also were feeling a little exhausted.

It was characteristic of Pearson to " formulate methods " on sight of his problem, but this particular problem had baffled engineers for centuries and was scarcely to be solved on a voyage home. The Valley of Mexico is an immense basin over 7,000 ft. above sea-level, surrounded by vast rocky and snow-clad mountains enclosing an area of some 2,220 square miles. No water drained out of it, and in primeval times it was an unbroken expanse of inland sea or salt marsh. Seepage and evaporation gradually reduced the waters, leaving a chain of lakes, and in the fourteenth century Aztec pilgrims from the north, having received a sign that they were to raise their great city on an island in this valley of waters, set about building dykes and reclaiming the spaces between them. The first Aztec city with its temples and wigwams was built on piles in the middle of what was then Lake Mexico, and since its streets were mainly canals between the dwellings, it was not greatly troubled by the overflow from the lakes above it. But when Lake Mexico disappeared, having partly evaporated and partly flowed down into the fissures caused by earthquakes, the city remained planted on spongy soil and at the mercy of floods, which every twenty years or so poured over the dykes and kept its streets under from two to six feet of water for weeks or months together.

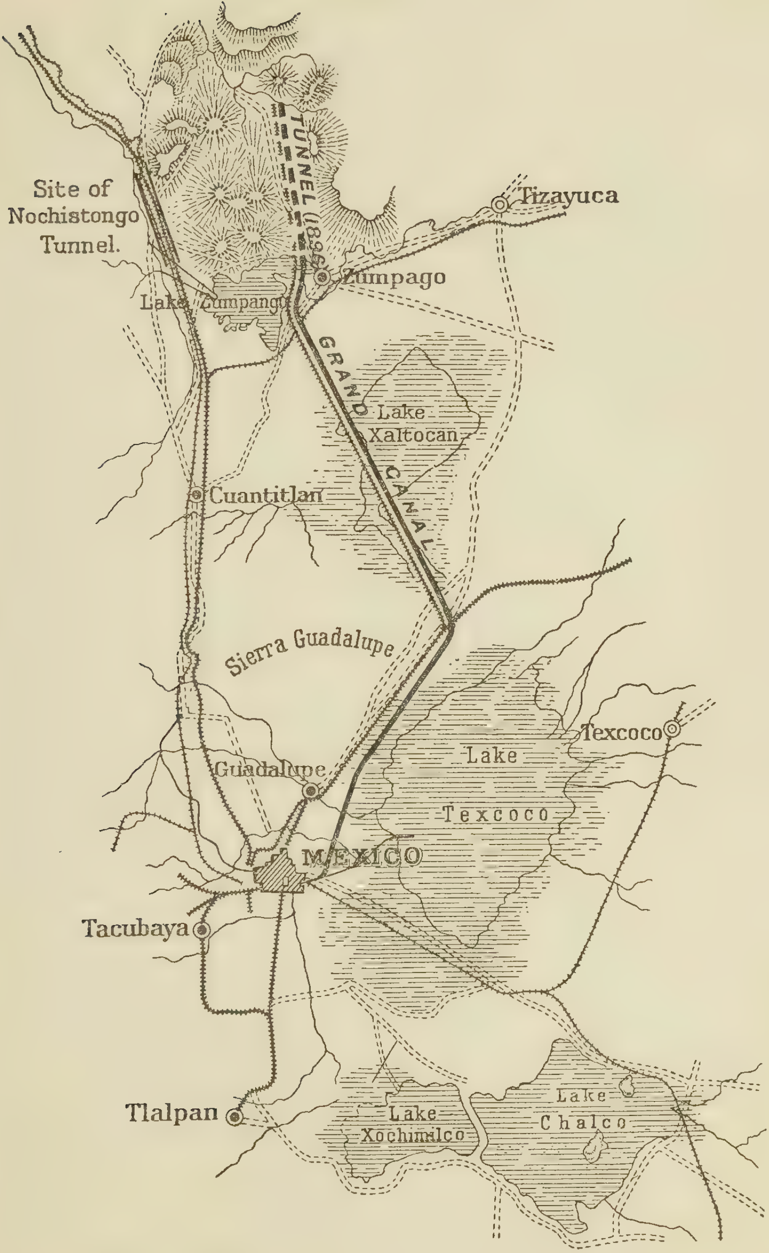
It was recognized too late that Cortez had made a disastrous mistake when he decided to build the capital of New Spain on the ruins of the Aztec town, but the city being there and in spite of everything growing rapidly in population and wealth, the problem for his successors was to avert the floods by draining the valley and keeping the dykes in repair. For the drainage part of the problem there was only one solution—to make an artificial outlet for water through the mountain barrier; and for this again there was only one likely place, and that was to the north of Lake Zumpango, thirty miles north of Mexico City, where the mountains are somewhat lower than the general level. A cut or a tunnel through them at this point joined up by a canal with Lake Zumpango would enable this highest and most dangerous of the lakes to be drained off into the river Tula on the far side of the mountain barrier, and prevent its overflow from running southwards into the Mexican basin and raising the level of the other lakes.

The problem was correctly seized at the beginning of the seventeenth century by one Martinez, a humble printer, who proposed a tunnel through the mountains at Nochistongo, and in the year 1607, after much importunity, persuaded the rather reluctant authorities in Mexico City to undertake it and put him in charge of it. The tunnel had to be ten miles long and fifteen feet wide by twelve in height; but by keeping 15,000 Indians incessantly at work he managed to complete it in the incredibly short time of eleven months. Unfortunately, funds failed to line it with masonry, and when the waters of the Zumpango were turned into it, the timber supports caved in and falls of earth seriously blocked the fifteen-foot channel. In 1627 the Cuantitlan river, which flowed into Lake Zumpango and should have been carried off by the tunnel, again overflowed into the lower lakes, and Mexico City was once more under water. Two years later the water rose to 6 ft. in the city and remained at or near that level for the next four years. There were serious thoughts of removing the city to higher ground, but it was impressed on the authorities that it would be far less costly to repair the tunnel and complete the drainage scheme than to rebuild the city, and for several years they halted between the two decisions.

The situation was relieved in 1634 by a timely earthquake which made a fissure in the valley and drew off the water, and the Mexicans now turned their thoughts to mending and enlarging the tunnel. By this time Martinez was in disgrace, and when the earth again caved in and killed his workers and blocked the tunnel, he was thrown into prison and charged with creating the obstructions which he was struggling to remove. Since no one else was capable of doing anything, he had to be released after a few months, and again put in charge, but by this time it had been decided that the tunnel was useless, and that the only thing to do was to open it up by a great cut downward from the top of the mountain. This entailed making an excavation fourteen miles long, with an average depth of 180 ft. and width of 400 ft. These figures convey little of the reality as it looks to the eye, but so immense is the excavation that the train which now passes through it on a "bench" cut in half-way up one side looks a mere toy against the background.

This stupendous task was accomplished, but it proved to be the longest and cruellest engineering operation recorded in history. Martinez struggled on with it for the next thirty-seven years, and died without honour before the beginning of the end was in sight. With numerous interruptions caused by political troubles or depleted treasuries, the Spaniards pursued it for a hundred years longer, and finally made a sufficient opening to carry off the waters of the highest lakes and streams. Slave labour, forced labour,

Fig. II.


Site of
Nochistongo
Tunnel.
TUNNEL (1896
Tizayuca
Zumpago
Lake Zumpango
GRAND CANAL
Lake
Xaltocan
Cuantitlan
Sierra Guadalupe
Texcoco
Lake
Texcoco
Guadalupe
MEXICO
Tacubaya
Tlalpan
Lake
Xochimilco
Lake
Chalco

The Grand (Main Drainage) Canal. Valley of Mexico.

prison labour were all enlisted and kept at work with a callous indifference to its fate. The neighbouring towns and villages were depopulated of their male inhabitants, and when these proved insufficient large numbers of Indians were brought from Puebla and other thickly populated Indian centres. Great prison barracks were built on the hillside and convicts set to work in chain gangs. It is estimated that from first to last not less than 200,000 lives were sacrificed, many dying of disease and others being smothered in earth or crushed by falling rock.

The greater deluges ceased when the cutting was opened, but since the bottom of the cutting was thirty feet above the level of the lowest of the lakes (Lake Texcoco), the city was still in danger of inundation, and a large part of its drainage problem remained to be solved. Year by year during the next 150 years the valley about the City of Mexico was more or less flooded, and, with the lake levels generally above the level of the pavement of the city, it was extremely difficult to find outlets for flood-water, or for what was even more important, sewage. If no longer in danger of drowning, the inhabitants were still in danger of dying of disease. So from the middle of the nineteenth century onward the project of a new tunnel running almost due north from the north-east corner of Lake Zumpango—passing under the saddle and through the ravine of Acatlan—began to be considered (see Fig. II. p. 89), and was actually taken in hand in 1866 on a plan devised by the Mexican engineer, Francisco de Garay. It was abandoned in the revolutionary troubles that followed, taken up again in 1879 and stopped again in the following year on account of further political troubles. A serious beginning, however, was made in 1885, when President Diaz appointed a special Commission to supervise the work, for which funds were provided jointly by the Federal Government and the City of Mexico, the City raising a loan of £2,400,000 in London to finance it.

After a brief experiment the Commission decided to take the work out of the hands of the Government Department and place it with competent contractors. A London firm secured the contract for the tunnel and an American Dredging Company that for the canal. Four years later the Commission being disappointed with the progress made, rescinded the latter contract, and at this moment Pearson came on the scene.

He judged the general scheme to be quite sound. Nothing better could be suggested than Francisco de Garay's plan, accepted in 1865, of constructing a canal to carry the sewage and storm-water of the city into a canal through the shallows of Lake Texcoco; prolonging this canal through other lakes to a tunnel under the mountain and using it to drain the excess waters of these lakes into the river on the north side of the mountain barrier. But there were some serious difficulties, not the least being that the tunnel and the canal were in the hands of separate contractors, whose work would need to be very carefully timed if unforeseen and undesired results were not to follow from the troubling of these waters. The Firm had already received a warning on this and other matters from its agent on the spot. It is small wonder that Pearson confesses to having had three very anxious and perplexed months after he had signed this contract. When he left Mexico he arranged with a Mexican engineer, who had been educated at Stonyhurst, to carry on until his plans were laid, but carrying on after the manner of his predecessors in the contract was, as he well knew, merely marking time, and he had now to decide on his own plan of campaign. In the notes from which I have already quoted he has left a record of his wrestling with the problem and the conclusions that he reached :

> There were many methods by which this great canal, involving the removal of many millions of tons of excavation could be constructed. French methods, German methods, American methods were each individually considered and rejected. Part of the work had already been done by hand labour, the peons, that is the native Mexican labour, carrying out the excavated material on their head or back—a method they were used to. I had set my face against employing dredgers, although the idea was always there as a last resource, but the cost of building dredgers, transporting them in shipable parts, conveying them from Vera Cruz—

> at that time an open roadstead—to the Valley of Mexico, and there erecting them, presented such a high initial capital outlay as to render that method undesirable if other methods equally effective could be found. But after 3 months' studies and rejection of innumerable methods, and after the subject had become more or less a nightmare, I had to adopt the dredging method. I therefore asked Mr. Lobnitz of Renfrew to come and see me with a view to arranging a contract for 5 dredgers similar in principle—but more stupendous[1] in their range of operations—to those dredgers he had been supplying for the construction and widening of the Suez Canal. Mr. Lobnitz responded, and he agreed that we should lock ourselves up in my office until we settled the matter. We were 3 days under lock and key and until 9 at night; but we finally evolved a tool that answered perfectly. In the end our largest dredger was capable of dredging to a depth of 50 ft.; the string of buckets was some 150 ft. in length from top tumbler to bottom tumbler, and it deposited the material dredged into huge shoots capable of projecting it 200 ft. from the centre of the dredger to the bank. These shoots were carried by suspension ropes from high derricks erected on the dredger itself; powerful pumps washed the material down the shoots ashore. In fair ground each of the dredgers removed over 4,000 cubic yds. of excavation per day and the dredger with the best month's output carried with it for the next month the champion flag and big bonus.

The work was begun in January, 1890, and finished in June, 1896, the Firm's agent in charge being Mr. T. L. Walsh, whose two sons, Messrs. A. C. and J. L. Walsh, hold responsible positions in the Firm to-day. The first stage was to excavate the bed of the canal sufficiently with hand labour to float the dredgers, the separate parts of which were assembled and put together in a dock connected with the canal. The

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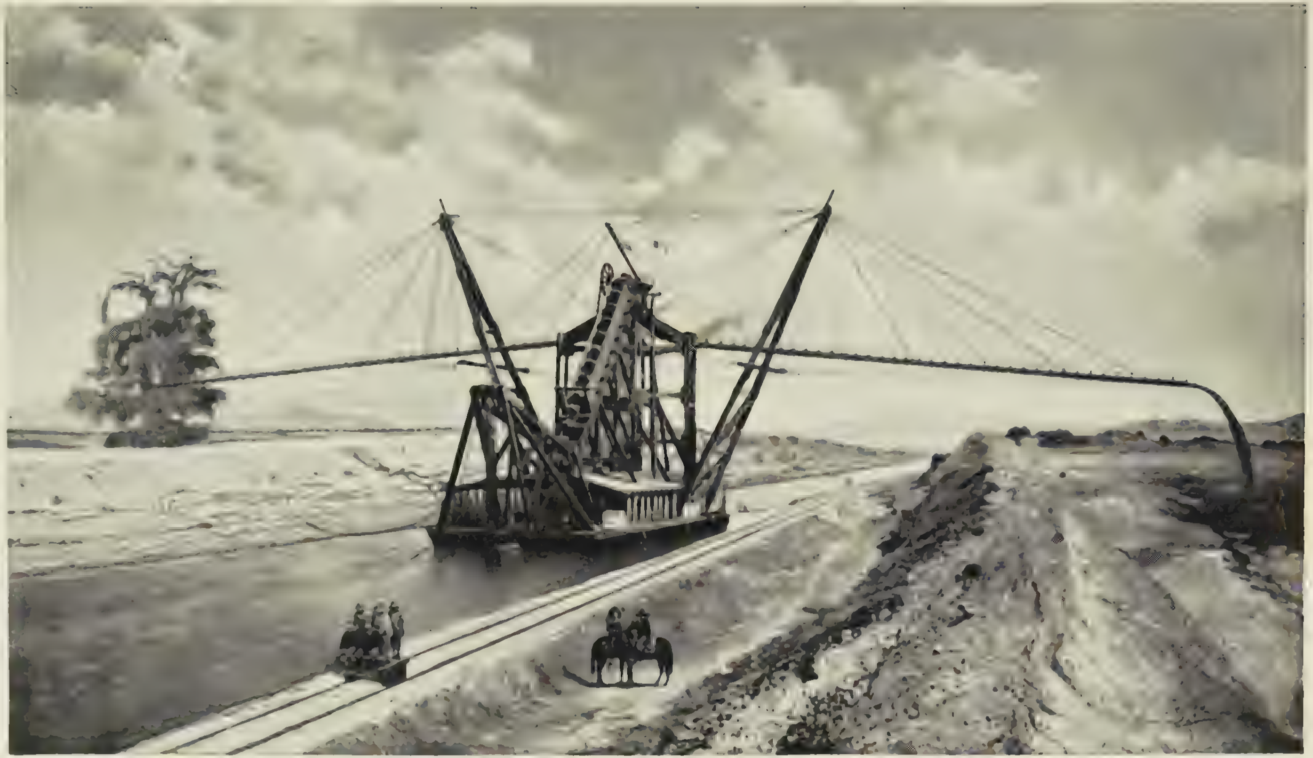
[1] Stupendous at that time. The suction dredgers since invented have a much larger capacity.



DREDGER ON THE MEXICAN GRAND CANAL

From a painting by M. R. Hernandez

bed, carried thus far by hand labour, was then filled with water and the dredgers set to work to deepen it to the required depth. When they had done their work, the dredgers were brought back to the dock and dismantled, and the water was drained away through the tunnel (which had in the meantime been completed) at the north end of the canal. The dredgers worked day and night and did all that was expected of them. One working in soft soil dredged 124,230 cubic yds. in a month, and a fair average in hard and soft was 90 cubic yds. an hour. But much still remained to be done on the bed of the canal after the dredging had been finished. The slopes had to be trimmed by hand labour and a good deal of material taken out which the dredgers had been unable to reach. For this latter purpose an apparatus known as the Lidgerwood Cableway was brought into play. This consisted of two timber towers, 65 and 35 ft. high respectively, one on each side of the canal mounted on rails laid on short lengths to enable them to go forward. These towers were connected with an endless chain of steel cables on which buckets, worked by engines or dynamos on the head tower, made round trips, running out, lowering, grabbing, raising, running in and dumping in less than two minutes on the average, this time including stoppages and moving ahead. The head tower was advanced by means of a small warping barrel on the end of one of the drum shafts, and the tail tower by a 7-ton hand winch, posts being sunk in the ground in each case at intervals ahead, in readiness for attaching the tackle. This cableway travelled 11¼ miles and excavated 139,000 cubic yds. During much of the way water was filtering through into the canal from the lakes and had to be controlled by timber-sluice dams, which held it up and enabled the Indians to work at the bottom and clean up after the cableway, which was kept ahead of them. Indian labour proved quite satisfactory, provided always that it was efficiently supervised and care taken to keep the work to proper line and level.

A three-foot gauge railway was constructed for about nineteen miles along the benching of the canal and connected at the thirteenth mile with the Mexican and Hidalgo Railways, and at the end of the canal with a branch line to Zumpango and the tunnel. This was afterwards taken over by the Government and used for passenger service. In addition, aqueducts had to be constructed to carry the small rivers from the hills to the west of the canal over it into the Lake Texcoco, and steel or iron bridges, one with a 175-ft. span, to carry roads and railways across it. The total length of the canal was 29½ miles, with a depth ranging up to 72 ft., and the total excavation approximated 15,000,000 cubic yds.

Pearson was constantly on the spot applying his mind to the problems and emergencies which presented themselves as the work went forward. More and more he was thrown into intimate relations with President Diaz, of whose character and abilities he quickly formed the high opinion in which he never wavered to the end. One characteristic incident in his dealings with the President is related in the notes from which I have already quoted :

> To show how well General Diaz understood human nature and how superbly he handled it, I will refer to one incident that occurred, when we inaugurated the first of our five dredgers, about a year after the contract was signed. The inauguration was made a gala-day, and the President, with his Ministers, the Diplomats and the leading people and fashion of Mexico City were there. I took the opportunity of telling the President that we should have had a second dredger ready to inaugurate if it had not been for the delays caused by the non-delivery of our material by the Railway Company from Vera Cruz. Vera Cruz was then an open roadstead, and during the norther season (as it is called—when dangerous hurricanes frequently arise and last for days at a time, and when ships had to put to sea for safety) very little traffic could be landed. It was the policy of the Railway Company to run to Mexico City one through freight train per day as a minimum all the year round, and in order to do so to accumulate freight in their yard at Vera Cruz during the non-norther season to keep its train going during the norther season. Notwithstanding our day-by-day protests, our material was being kept at Vera Cruz for this purpose, and consequently I had to

> make my appeal to the President. The Managing Director was called by the President and told my allegation. His reply was characteristic: "Senor Presidente, I listened, I may say, without surprise to Pearson's complaints, as we receive many such complaints. We usually find that the goods have missed shipment in England, or that the ship carrying them has had to run to sea on account of a norther before she sent all her goods ashore. As you know, it is not unusual for such ships if they have got the bulk of their cargo ashore not to return but to proceed with their itinerary. Of one thing I can assure you, and that is that I am sure that any goods that are needed for any Departments of the Government are sent without delay, but I will, of course, immediately inquire into the matter." The President listened quietly to what the Managing Director had to say, and then said: "Don't inquire, but send the material." Two days afterwards we had a train-load of it. This is only an instance of the effective manner in which President Diaz so successfully dealt with the people throughout his great country, whether natives or foreigners.

In spite of the President's goodwill, it was by no means all plain sailing between Contractor and Government. A prominent member of the Commission who had been absent in Europe when the contract was signed complained bitterly on his return that the Government had conceded too much, and remained a thorn in his side to Pearson in this and many future undertakings.

Then there were difficulties about finance which taxed to the utmost his own ingenuity and that of Mr. Clarendon Hyde, who worked intimately with him in all questions touching finance. Sometimes he had to accept payment in Mexican internal bonds and Treasury notes and sometimes in silver, of which Mexico is the great world-producer. There were considerable risks in holding silver. India is the great consumer of that metal, and many tons pass through the London market on their way to India. Once when Pearson had nearly 50 tons of silver in London, India ceased to buy and silver fell heavily and for a time was a drug in the market. The position was serious. With characteristic resourcefulness, Pearson rose to the occasion. He started out to create a local demand for silver by the manufacture and sale throughout the United Kingdom of silver spoons and forks of the best quality and at a price giving the purchaser the full benefit of the cheap price of silver. Negotiations were carried through with a great manufacturing silversmith and everything was prepared for the utilization of Pearson's silver when the market began to rise, and India again became a buyer, and silver reached 25d. The 50 tons of silver disappeared in a fortnight to meet the Eastern demand, and the spoon and fork scheme never materialized. Years after, when they were dining together at the House of Commons, Sir Michael Hicks-Beach told Pearson of the interesting experiment for the absorption of surplus silver on the London market which came under his notice whilst Chancellor of the Exchequer. He was greatly interested to learn that the scheme was Pearson's and only regretted that it had not proceeded.

In the end the work was completed within the stipulated time to the entire contentment and admiration of the Mexican Government. The Pearson Firm had been the first in Mexico to live up to both the letter and the spirit of their contract. They stood out at the beginning for what they thought to be equitable terms, but having got them, they asked for no amendment in their favour, and made no complaint when unexpected difficulties arose. Seeing what successful progress he was making with the canal, the Government had wished Pearson to take on the tunnel, which in the hands of other contractors was making very slow progress and threatened to hold up the completion of the Canal. He was willing to do it, but only on terms which he thought fair, and when these were not conceded, he stood out and left the Government to complete that part of the work.

Mr. Patrick Ryan, who was in charge of the dredgers, supplies some memories of these times:

> One day Mr. Weetman Pearson came up to the small Dockyard at San Cristobal, where the parts of the dredgers sent out from England were being

"assembled." After looking a long time at those dredgers under construction, he said, "Ryan, I have been looking at those painted figures on the side of that dredger. What do they mean ?" I replied, "The riveters are working with a fine spirit of competition." The first and smaller figures, 500, represent the best day's work done by a gang, and the last and largest figures, 762, is the best day's work to date. When you go back to England and tell them we are driving that number of rivets by hand with Mexican Indian holders-up and heaters, they will hardly believe it." He laughed, and slapping me on the shoulders, said, "Ryan, it's worth the paint." He then asked me when the dredger would be floated. I answered, "In three weeks." "If you can float her in two weeks, Ryan, I'll give you a bonus of 500 pesos." I agreed to try, and by concentrating my force on the hull I won the bonus.

The first dredger was called the "Carmen," after the President's wife. President Diaz came down to San Cristobal and pulled the lever to start it in operation. A banquet was served in the interior of a dredger under construction from which we removed the bulkheads. It measured 120 ft. long, 40 ft. wide and 10 ft. in depth, and was very tastefully decorated with Mexican national colours. The tables were lit by coloured candles. The President sat down at the head of the tables under a life-size oil painting of himself, and before him on the table was a very artistic model of the dredger made of sugar by the excellent cook. The various Foreign Ministers were present, and the first large banquet given by the "Chief," as we now called him, was a great success.

His courteous and naturally genial manners greatly helped him in his dealings with the highly cultured officials who ruled in Mexico at that time. One Christmas Day he gave a dinner to the Staff and employees at San Cristobal. Some hours before the dinner we were talking and I suggested that it might be a good thing to invite the village president, the magistrate and the padre. He at once wrote out their invitations and sent me on horseback to deliver them. They came and enjoyed a fine English Christmas dinner and drank his health in Spanish, " Salud, Señor Don Weetman Pearson "—in fact they drank his health so often that it slightly affected their own, and we gracefully assisted them into their saddles at the close of the festival.

Two other superintendents and I had a Chinaman cook in our digs. Through some misunderstanding, he was taken away, so we knocked off work and went up to the City. Getting off the train, we went straight to the "Café de Paris," then the best restaurant in the City. There were little side places with tables for six. Heavy curtains were hung at their entrance ; we had scarcely looked at the menu when the curtain was pulled aside, and Carlos de Landa y Escandon, the Chief's private secretary, looked at us. The surprise was mutual. He apologized, refixed the curtain, and passed on, and through a gap we saw Mr. Walsh and the Chief, who had arrived from England that morning. We heard Carlos say, " Ryan, Menzies and Clark are in there." The next moment the Chief came in smiling ; we shook hands ; he sat down, Walsh and Carlos followed suit, and we had a splendid time. He paid the checks for all, and we kept mum about our trouble. Walsh whispered that our cook was to be restored to us, and we returned to work next morning. Our strike was off.

His kindness to old employees was well known. A Scotch blacksmith, John Patterson, took ill. John had worked on the Firm's first contract at King's Lynn, England. The Chief arranged that the blacksmith and his wife should go back to England on the same ship as himself. I could cite many cases of his generosity.

One night in the City of Mexico the Chief and Mr. Walsh went for a walk. They saw a man lying asleep so near the edge of a stream that he was likely to fall in, so they moved him to a safer spot and left him. Next day the Chief and Walsh took the Pulque train from

> the City to the works at San Cristobal. The train had only two compartments like the English trains. Just as the train started the man they had helped the previous day opened the door and got in. He was a tough-looking Hobo and had been drinking freely. He informed them that he was Jock F., a coppersmith from Leith, Scotland, and he was sent out to instal the copper pipes on the dredgers for S. Pearson & Son, whom he denounced in fierce language. Moreover, he had written to his lawyer in Scotland to take action against S. Pearson & Son for breach of contract, etc. The man was entirely unaware to whom he was talking. The Chief did not reveal his identity, and when they arrived at San Cristobal gave orders to get the man to work as soon as possible as that part of the work was behind.

While there was an eight-hour day for most of the eleven hundred men engaged on the canal, Pearson himself was often out for ten or eleven hours, consulting, observing, inspecting, on all sections, and by night as well as by day. His notebooks filled with pencil jottings in his small neat hand record personal observations about the qualities and characters of the workers side by side with careful calculations of the cost of excavation and the average work done by the dredgers and the shifts of men. He notes that A. is to be given a wedding present of a hundred dollars, B. a bonus for " close attention and heavy work," and C. a gold pencil-case for careful inspection of the screening of coal. On the next page an elaborate calculation shows discrepancies in the performances of the dredgers; Carmen is falling behind Conchita, and she must be brought to book, and so must Annie and Lucy, who are in the same plight. But bonuses are to be paid to dredgers for actual work done and time worked. Economy and speeding-up throughout, but without skimping and driving; the best material is to be used, and men who show signs of fatigue are to be given rest or lighter work. Towards the end a careful programme is laid down for the last lap, so that all may be finished by the appointed date, dredgers and cable-way being each assigned their portion week by week, and handwork similarly apportioned.

When he returns to London, he remains in close touch, calling for full weekly reports of working, prospects of work, dates when each separate part is expected to be finished, and monthly accounts of expenditure. He directs that the expenditure per month is not to exceed a certain amount in Mexico and a certain amount at home, and his departments have to work within his estimates or show very good reason for failing to do so. Apart from other financial problems, the variations in the exchange value of the Mexican dollar always required careful watching, and it never could be quite forgotten that Mexico was a Spanish-American Republic. He asks rather anxiously at one moment whether the Government has carried out its promise to obtain the whole sum in one vote, or is leaving the contract and the contractor to the hazard of a yearly vote and the possible mutations of Mexican politics. The London side of the business included the buying of machinery and material, which could not be had on the spot, arrangements for transport and freight, and the choice of men for expert jobs. So far as he could, Pearson availed himself of Mexican engineers and workmen, but they needed to be supplemented by a certain number of highly efficient English and Scotch, and he carefully supervised the selection of these. Nothing, in fact, served him better throughout his life than the almost uncanny faculty which he seemed to have for choosing the right man for a particular job.

CHAPTER X

THE VERA CRUZ HARBOUR

The Vera Cruz Harbour—Unloading in Troubled Waters—A Formidable Project—The Breakwaters and their Technique—The Plant Employed—The Workers' Township—Water-supply and Drainage—Modernizing the City.

As related in the previous chapter, Pearson had found himself seriously handicapped in constructing the Mexican Grand Canal by the difficulty of getting his material landed in the dangerous harbour of Vera Cruz. That harbour was exposed to the full force of the north winds, or "northers," which blew incessantly, and sometimes with hurricane force, during several months of the year; and for that time the only shelter for vessels was in the small space to the lee of the Castle of San Juan de Ulua built on a part of the Gallega Reef. During this dangerous season ships had to keep steam up so as to be able to put to sea at once on the approach of a norther, and even on relatively calm days were obliged to keep their propellers working in order to ease the strain on their moorings. Further, since there was no pier or wharf with a sufficient depth of water alongside to enable ships to come up to it, loading and unloading had to be done by lighters, and often in such troubled waters as to make the handling of cargoes both difficult and dangerous. All work had frequently to be suspended, many goods were damaged, and some went to the bottom instead of on board the lighter. A ship captain who got into the harbour and got away after landing his cargo safely during the norther season counted himself a happy man.

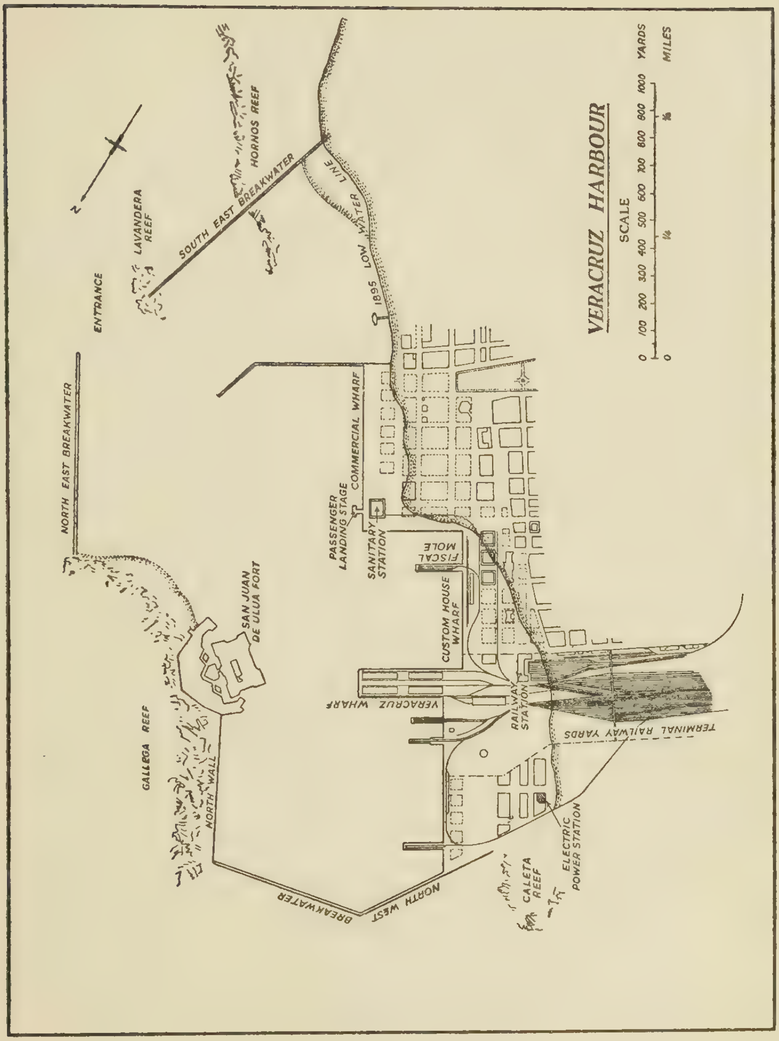
It had long been evident that Mexico could make little progress in oversea trade if her principal door of entry from

Europe was subject to these conditions, and a certain amount of pioneer work towards its improvement had been done before Pearson came on the scene. Eads, an American engineer, who had been responsible for the jetties at the mouth of the Mississippi, had, at the request of the Mexican Government, made a thorough survey of the port and a careful study of the tides, winds and prevailing currents, and on this basis submitted plans for a new harbour. A French engineer afterwards made a similar study and also submitted a scheme. After studying the ideas of both these advisers, the Government made a contract with Mr. Agustin Cerdan, of Mexico City, to construct a breakwater from the shore to the north of the town to the island of San Juan de Ulua. But this had unexpected and disconcerting results upon certain currents and had hastily to be stopped lest the harbour should be silted up. The Government then saw that the problem would have to be faced on much bolder and more comprehensive lines, and commissioned Mr. Lavit, a Mexican engineer, to draw up a new and larger scheme, based not only on the previous plans but on more recent experience in harbour construction.

With this scheme in their possession, it was natural that the Government should turn to Pearson. He had earned their confidence by his work on the Grand Canal; they knew him to be supremely competent and straightforward in all his dealings. If anyone could carry through this work without miscalculations which would make bad worse or land them in unforeseen expenditure it was he. But the project was an enormous one which needed a very cool head and the nicest calculation of its difficulties, if the contractor too was to escape disaster and come out of it with credit. Looking seaward from the shore on a day when the " norther " was piling up the waters, even the hardiest of engineers and contractors might have felt some shrinking of the spirit when called upon to make a safe modern harbour out of this windswept roadstead with its sunken reefs.

The specification does indeed look formidable. The contractor was to deepen the entire harbour to a depth of 8·50 metres and part to 10 metres; to complete the existing breakwater and build two more—one in a south-easterly and

Fig. III.


VERACRUZ HARBOUR
SCALE
0 100 200 300 400 500 600 700 800 900 1000 YARDS
0 ¼ ½ MILES
N
NORTH EAST BREAKWATER
ENTRANCE
LAVANDERA REEF
SOUTH EAST BREAKWATER
HORNOS REEF
1895 LOW WATER LINE
COMMERCIAL WHARF
PASSENGER LANDING STAGE
SANITARY STATION
FISCAL MOLE
CUSTOM HOUSE WHARF
SAN JUAN DE ULUA FORT
GALLEGA REEF
NORTH WALL
VERACRUZ WHARF
RAILWAY STATION
TERMINAL RAILWAY YARDS
ELECTRIC POWER STATION
CALETA REEF
NORTH WEST BREAKWATER

the other in a northerly direction—both with solid concrete blocks and hurricane-proof, and having thus enclosed a space of 2,500 metres by 900, he was next to build a jetty of solid masonry 880 metres long with a depth of 10 metres at low water alongside for the unloading of ocean steamers; two iron jetties 180 metres long with 8·50 metres of water also for ocean traffic; and finally stone quays on the northern shore with three metres of water for coastwise and smaller craft. He was to do all this under a time-limit which required him to complete 200,000 cubic metres of breakwater and other constructions a year, which meant completing the north-west sea-wall within two and a half years, providing accommodation for discharging six large ocean liners in four years, and completing the whole in five years. The amount of the contract was £3,000,000.

The contract was signed in April, 1895, and no time was lost in preparing for the work. The reader will best understand the operations that followed if he will cast his eye along the line on the accompanying plan (Fig. III, p. 103) marking the original shore of the Bay and imagine all else to the north of this deleted except the markings of the coral reefs and the Castle of San Juan, which was built on the Gallega Reef and formed an artificial island about half a mile from the shore and due north of it. Except in so far as the reefs broke the force of the water, the harbour was really an open roadstead and had almost no protection from the north and north-east. While providing some shelter, the reefs were a danger to shipping which had to find its way in between them. They were, however, an unqualified advantage to engineers and contractors, who were able to use them for a large part of the projected sea-walls for the protection of the new harbour. Thus the breakwater to the north followed the line of the Gallega Reef until it turned east towards the entrance to the harbour, and those on the east and west were similarly helped by the Hornos and Galeta Reefs respectively.

When Pearson took up the work, the northern wall from the west end of the Gallega Reef to the Castle of San Juan de Ulua, a distance of 500 metres, had been completed in concrete by the previous contractor, Mr. Agustin Cerdan, who had also laid " random blocks " of concrete for a part of the course to be followed by the north-west breakwater. But all else remained to be done. Pearson began on the north-west breakwater by laying a rubble foundation up to low-water mark, building for this purpose a trestle of creosoted piles five metres above low-water on which the stone trains were run out. Upon the foundation thus laid, 35-ton concrete blocks were carefully laid for line and level by a 35-ton crane, which travelled on a railway track laid on top of the breakwater as it was constructed. The blocks were then left to settle for two " norther " seasons, after which they were finished with a coping in concrete which brought the wall to a height of 4¼ metres, or 15 ft., above low-water level. The average width at the top was 12 and at the bottom of the rubble slope 30 metres.

When the reef failed, a foundation of rubble stone had to be laid in the bottom, and this was conveyed partly in barges and partly in cars running over the trestle. As the north-west breakwater was completed, the trestle was dispensed with and a line laid down to carry the rubble in trains to the north breakwater. For the last section of this, from the Gallega Reef eastward to the entrance of the harbour (738 metres), the rubble foundation had to be laid in thirty-five feet of water, and brought up to within ten feet of low-water mark. It was carefully levelled by divers, and sloping concrete blocks were laid upon it by the 35-ton crane aided by two floating cranes of the same capacity. At the same time concrete blocks were thrown " at random " as wave-breakers along the exterior side of the breakwater. Then again the work was left for the settling and testing of two " norther " seasons, after which it was finished with a concrete coping. The average width of the breakwater at this point was 30 metres, and at the end of it was a handsome lighthouse, which marked the entrance to the harbour and faced its fellow at the end of the south-east breakwater. That breakwater had in the meantime been pushed forward from the Hornos Reef, and when it was finished the stormy open roadstead was converted into a large and deep-water modern harbour of 540 acres, completely enclosed except for the passage, 250 metres wide, between these two breakwaters, and with a depth of water up to the principal piers and jetties sufficient for the largest ocean-going steamers. This was the most formidable part of the work, but in addition there were the piers and jetties of the inner harbour including in all about half a mile of deep-water masonry quays, three-quarters of a mile of steel and timber piers, and two miles of stone-built town quays running along the whole front of the harbour, to be constructed. In the course of these operations, 247 acres of land, which subsequently became of great value, was reclaimed from the sea and made available for sidings and warehouses, parks and public buildings.

The plant employed was—according to the standard of that time—immense, and of the most modern type. A specially constructed dredger capable of excavating 2,000 tons, stowing it on board, carrying it out to sea and dumping it into the Gulf of Mexico, came out under her own steam and did the main work in the harbour. In addition, there were rock and sand bucket dredgers, suction dredgers for pumping sand through pipe lines, and many tugs, stone barges, block barges, block carriers and smaller craft. There were block yards for the preparation of the concrete blocks, with their floors laid to a true level and lines set out for the accurate construction of each block. Work in these was carried on night and day, the crushed rock, sand and cement being prepared at night and carefully measured for the next day's work. As fast as they were made, the Goliath block carrier, an enormous crane mounted on rails, took the 35-ton blocks and stacked them where they were needed. Six floats and a large diving outfit were needed for the divers who levelled the rubble of the walls and breakwaters and set the blocks below water. Many of these divers came out from England and worked with Spanish and Mexican assistants. They often saw but were never attacked by sharks, and during the whole course of the work there was not one fatality among them.

The stone for the work was brought from quarries sixty miles inland, the railways often running four stone trains a day, for which the contractor supplied the cars. Apart from this the contractor had thirty kilometres of railway of his own equipped with locomotives and rolling stock. Vera Cruz being at that time a notoriously unhealthy place, very careful arrangements had to be made for the housing of the European staff. A little township was built on the reclaimed land within the town quay and provided with its own sanitary system and a supply of drinking water from the Jamapa river. A Mexican observer records that " a glimpse into the houses as one passes reveals that attention to comfort, cleanliness and decency which are characteristic of English people wherever they go." All the houses were lit with electric light—then in its infancy as a mode of illumination—and everything possible was done to make life cheerful as well as healthy. Thanks to these precautions, the average of health was remarkably good, and most of the employees were able to live and work for the whole period of the contract without catching yellow fever or in any other way suffering seriously from the climate.

The various operations have to be described separately, but many of them overlapped or went forward simultaneously, the dredgers being constantly at work while the breakwaters were being constructed, and the stone piers and quays pushed forward as soon as sufficient shelter was provided. Time was, as always, of the essence of the contract, and at Vera Cruz, as on the Grand Canal, having got his terms, Pearson asked for no indulgences but drove straight through to the completion of the work within the stipulated time.

The completion of the harbour was only the beginning of Pearson's connexion with Vera Cruz. In the next few years he and his firm converted it from a squalid, malodorous, yellow-fever infested town into a prosperous modern seaport with good drainage, pure water supply, electric light, electrically driven trams and all the other appurtenances and amenities of a self-respecting city. In 1901, when the harbour works were in the work stage, he took on a new contract for drainage and water supply. With the growth of the population, the existing water supply, always contaminated, had become seriously deficient in quantity, and, as a local chronicler put it, had " lost its capacity to ascend to the upper stories of the houses." Pearson had never relied upon it for his own men, and in seeking to protect his workers' colony from sickness and epidemics, had found an abundance of pure water in the Jamapa river, which he now proceeded to use for the town supply.[1] The scheme for both water and drainage was laid down by Mr. William Fox, the eminent English sanitary engineer, and presented no special difficulties. A pumping station was established at Tejar, about nine miles from the city, and water pumped from the Jamapa river was discharged first into settling tanks, and thence into filter beds, from which it was pumped again into a service reservoir on the Medano del Perro, a sand-dune overlooking the city and about 40 metres above it. From this it ran by gravitation into the city and was distributed in the ordinary way. The citizens now had a supply of 225 litres a day per head in place of the previous 47, and there was no doubt about the capacity of the water to ascend to the upper stories.

The new sanitary system required the construction of a main brick-built sewer passing from the south-east outskirts of the city to a pumping station near the Gallega Reef, whence it was pumped after screening into a cast-iron pipe, which took it through the north-west breakwater and out to sea. Secondary clay-pipe sewers in and out of the streets and connected with the houses, joined up with this main sewer. In all some 55 kilometres of main and pipe sewers had to be laid. The city was now provided with a first-class modern drainage system, but Pearson wisely improved the occasion of its inauguration to tell the people of Vera Cruz that it depended largely on themselves to make it serve the purpose intended for it.

All this was in the day's work for the contractor, but he presently enlarged his operations, and with the backing of the President began to initiate schemes for the improvement of the city. It was useless to have a great harbour without the means of working it; evidently the railways had to be joined up with the port, and an adequate goods station with warehouses, sidings, and the necessary appliances for loading and unloading, including tugs and lighters, provided. Four railways ran into Vera Cruz, and they had undertaken jointly to form a company to furnish these necessaries. Pearson now arranged with them to form a company in London (in which he himself took a large interest), and was soon at work on the Terminal Station and its equipment. Next, he formed the Vera Cruz Electric Light, Power and Traction Company, obtaining the necessary concessions from the Municipality, and quickly superseded the ancient mule-drawn trams with a finely equipped electric system with modern cars. Simultaneously, he took the electric lighting in hand and brought a cheerful blaze of light into shops, cafés, private houses and promenades. These undertakings proved profitable to all concerned, and as more and more shipping came into the port, and trade increased, and fine public buildings rose on the reclaimed land, and public parks were laid out, it was small wonder that the people of Vera Cruz came to look upon the English contractor as a worker of miracles.

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[1] It may be mentioned that the United States Marine Hospital Service, which afterwards did such splendid work on the Isthmus of Panama, came on from Cuba to Vera Cruz and pursued there the researches into yellow fever which it had begun in Cuba. Its discovery of the mosquito which carried the germ greatly helped those in charge of the harbour works to check yellow fever among their employees. Much of the infection was now traced to mosquito bites suffered by men taking their siestas unprotected in daylight, and this was avoided by enforcing at all times the protection which had hitherto been adopted merely to save annoyance by night.

CHAPTER XI

THE TEHUANTEPEC RAILWAY

The Tehuantepec Railway—From Atlantic to Pacific—Early Plans for Canals and Roads—The First Railway—Pearson's Proposal—A New Form of Contract—The Deed of Partnership—The Vera Cruz Railway Company—Reconstructing the Tehuantepec Railway—The Fight with Climate—Capacity of the American Peon—Difficulties and Interruptions—Doing the Impossible—The Terminal Ports, Coatzacoalcos and Salina Cruz—The Shipping Agreement—Completion of the Work—Commercial Results.

The next great Mexican contract was that for the Tehuantepec Railway, which Pearson described at the time as the greatest of all his undertakings. In this, as it turned out, he was to be not only contractor, but manager and part-owner, sharing risks and profits with the Mexican Government.

From the earliest days of the conquest the idea of making the predestined cut between the Atlantic and Pacific across Mexican territory and through the Isthmus of Tehuantepec had been in the minds of the rulers of Mexico, and surveys for the construction of roads, digging of canals and deepening of rivers on this route may be found in their archives from the sixteenth century onwards. In 1550 the Portuguese navigator, Antonio Gavao, published a book to show that a canal could be cut at either Tehuantepec, Nicaragua, Panama, or Darien; but for the next two centuries the Spanish Government thought it much more important to develop trade with its American possessions than to provide a route to the Pacific, and it was not till 1771 that it began to take seriously any of these projects. Then it ordered a survey at Tehuantepec, with the result that that route was declared to be impracticable for a canal. But the ridge of the Sierra Madre, with its 700-ft. elevation, which the engineers had considered fatal to a canal, was no very serious obstacle to a railway, and from the middle of the nineteenth century onwards the idea of a Tehuantepec railway began to occupy the thoughts not only of the Mexicans, but of foreign engineers, promoters and concessionaires. The American railway king, C. P. Huntington, saw in it a threat to his own interests in the Pacific railways and made great efforts to obtain a concession which would have given him the control of this route, but he found more than his match in President Diaz, who was determined that the railway, if constructed, should be free and independent.

The story of these years is little more than a list of concessions given and cancelled, of American schemes for railway or canal, which foundered either on the demands of the Mexican Government or on the resistance of the Mexican people; ambitious projects of individuals who either failed to do the work or quarrelled with the Mexican Government, and generally seem to have succeeded in being bought out on advantageous terms. The best remembered of the projects of this time is that of the American engineer, Eads, who proposed a great broad-gauge railway to transport ships bodily from ocean to ocean. This, when it came to be examined, presented so many difficulties in construction and seemed so little adapted to modern shipping that it had only a short life, but the promoter was very much in earnest about it and was seriously disappointed when it failed to win approval. For the rest, there was a contract made with Edward Learned, of New York, who at least succeeded in building 35 kilometres of railway before it was wound up; another with Mr. Edward McMurdo, of London, for the reconstruction of what his predecessor had done, and when he died, yet another, also with a British group, for the completion of the railway. The last was hampered with financial difficulties—the loan of £2,700,000, raised at a heavy discount in London, having proved insufficient—but, with many changes in the conditions and the personnel, it stumbled on to the completion of some sort of railway in the year 1897.

From first to last some thirty-eight million dollars had now been spent on this scheme, and the result was altogether disappointing. The Mexican Government could indeed boast that “ ocean had been linked up with ocean,” but the railway which constituted the link was so flimsily built that it could not carry the heavy traffic which alone could have made it profitable, and the port accommodation at either end was so inadequate that it could not have been fed with this traffic if the railway had been able to carry it. Even the light passenger cars took from 15 to 20 hours to cross the Isthmus and were lucky if they escaped mishap. It was clear to President Diaz that either too much or too little had been done, and once more he had recourse to Pearson, the Englishman whose capacity and trustworthiness he had tested and proved at Vera Cruz and on the Mexican plateau.

Pearson instructed Mr. J. Meldrum to survey the ground and report to him about the condition of the existing railway. The report confirmed the worst that had been said about that railway, but encouraged the hope that if the right measures were taken, a serviceable line could be constructed. During the next year Pearson himself visited the Tehuantepec Isthmus with Mr. J. B. Body, and made a careful inspection of all sections of the railway. He came back impressed with both the difficulties and the possibilities of the enterprise. He saw at once that nothing would serve the purpose of inter-ocean communication but a first-class railway served at both ends with deep-water ports, and that to tinker with the railway without providing the ports would be merely to waste more money. But he was also convinced that this larger enterprise was quite feasible, and that with efficient management it was likely to be exceedingly profitable.

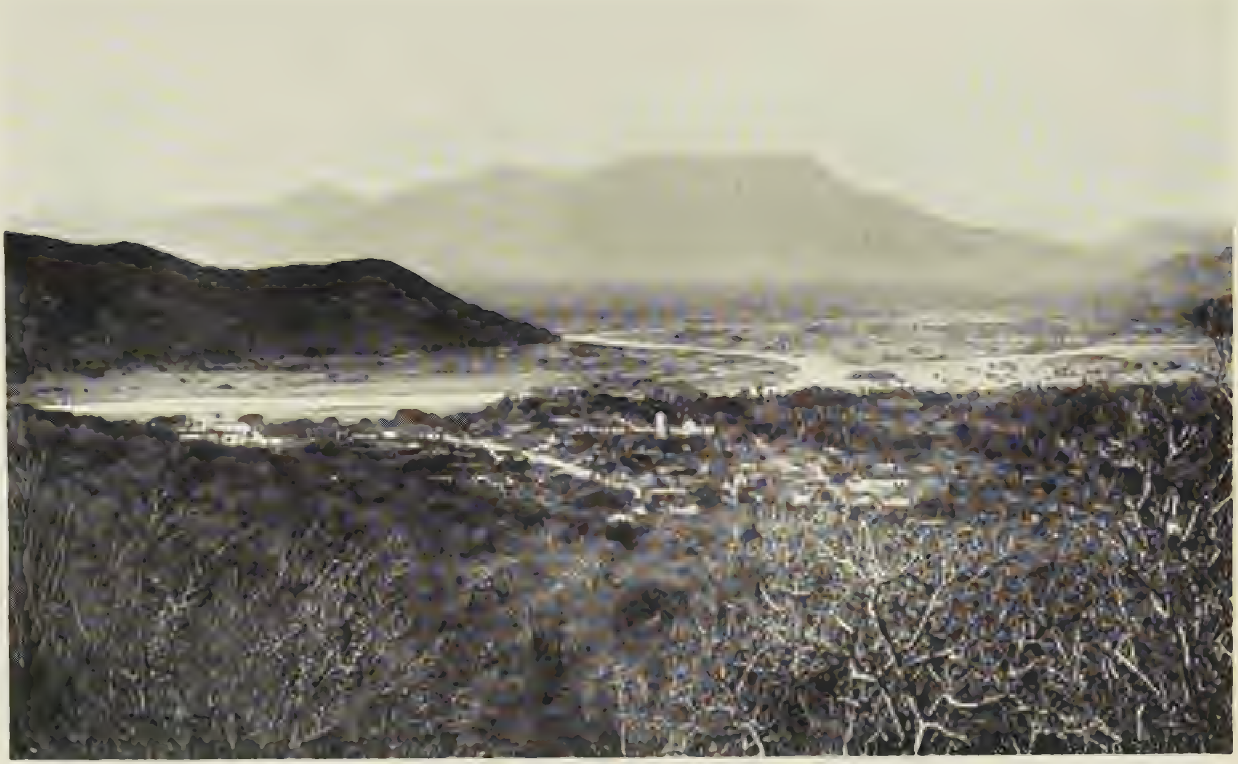
But if the large new expenditure was to be justified, the efficient management had to be assured, and he now took the bold step of proposing a new kind of contract under which he would not only reconstruct the railway and construct the ports, but run them, manage them, keep them in repair and take his remuneration in a share of the profits, if any, when the whole enterprise was in working order. This was a highly important new departure for him, and the turning-point in his relations with the Mexican Government. Hitherto he had worked as an ordinary contractor who retired from the scene when his work was done. Now he was to go into partnership with the Government, embark his own capital and share with them the profit or loss of an immense undertaking.

The contract, or deed of partnership, was formally concluded on November 18, 1899, and its details show the courage with which Pearson backed both his belief in Mexico and his confidence in the future of the Tehuantepec Railway. He undertook to reconstruct that railway at cost price, and to construct the two terminal ports under contract. When the railway was completed, he was to share any losses on its working equally with the Government, to provide half of a nominal capital of $5,000,000, afterwards raised to $7,000,000, whenever it was necessary to call it up; and if and when net profits, after paying fixed charges, were earned, to receive 37½ per cent. of them for the first five years, 34 per cent. for the next five, 30 per cent. and 26 per cent. respectively for the subsequent periods of five years. He also undertook to establish maritime services in both oceans, running in connexion with the Railway and establishing through routes between Atlantic and Pacific ports. The partnership was for fifty years from the completion of the railway, but it might be rescinded by the contractor if the losses exceeded $5,000,000, or by the Government at any time by buying out the contractor's share.

It seemed a bold plunge into the unknown, and once more the wise and prudent predicted disaster. It was said that Pearson had underrated the difficulty of constructing the harbours and making the good and solid railway, which alone would offer any prospect of earning profit, and that he had no experience of the new world into which he was plunging, and least of all of the formidable ways of the American Railway magnates whose interests would be threatened by any serious development of the Tehuantepec Railway or attempt on its part to obtain traffic from the Mississippi valley. It was pointed out that in all probability the Tehuantepec route would at best have only a short life, for the Americans were already busy on plans for either completing the Panama Canal or making a new one at Nicaragua, and it was improbable that any railway would be able to compete with a through water-way from ocean to ocean. Ten or twelve years seemed the outside estimate of profitable working for any railway across the Isthmus, and a considerable part of this time might easily be consumed in working the traffic up to the point at which it would earn a profit.

Whatever the outside appearances might be, Pearson was never a plunger, and it may be assumed that he had faced and weighed all these adverse factors before he committed himself. He was convinced, and, as the event proved, rightly, that the traffic was only waiting for the railway, and that there would be ample time before a canal could be in working order to make the enterprise profitable to both the Mexican Government and its partners. He believed that if rightly managed, it would keep sufficient traffic to remain profitable even after a canal was opened.

For the next few years a large part of his business in Mexico was in connexion with the Tehuantepec Railway, and to that he devoted himself unsparingly in association with Mr. Body. He had a train equipped for himself and his staff, and incessantly travelled up and down such parts of the line as would bear it, organizing, inspecting, suggesting ways of surmounting difficulties, supervising costs and estimates, dealing with voluminous detail and apparently keeping it all in his head. Later he had his own house at railway headquarters and lived there for weeks at a time. His general impression was that the existing line, though quite inadequate for the traffic he had in view, followed, on the whole, the best route. That was about 190 miles long in all, or about 50 miles longer than the straight line from coast to coast. It rose gradually from the mouth of the Coatzacoalcos river on the Atlantic coast, crossing several of its tributaries on the way, to a fairly flat table-land extending some eighty miles to the Jaltepec river, which had to be crossed by a bridge 560 ft. long. For another thirty-eight miles there was fairly easy going to the Malatengo canyon, and then a stretch through rock-cuts and chasms to Rincon Antonio, which became afterwards the centre for staff, yards and rolling-stock. A little beyond Rincon Antonio the Chivela pass had to be crossed at a height of 852 feet above sea-level—the highest point on the route—and this required two horse-



GENERAL VIEW OF TEHUANTEPEC

By permission of Ernst Wasmuth, Berlin.

shoe curves. Thence to Tehuantepec was a gradual descent of about 57 kilometres, and after 20 kilometres along the flat, Salina Cruz, the Pacific terminal, was reached.

The route being laid out for him, Pearson's business was to reduce gradients, straighten curves, substitute steel bridges and viaducts for wooden ones, relay and strengthen the bed of all parts of the line. The specification suggests nothing but what competent engineers backed with sufficient capital could carry through without difficulty in Europe, and the previous failures might be ascribed to mismanagement or lack of capital. But in fact the difficulties were very great. From June onwards for several months the rainy season made all constructional work impossible and threatened any that was unfinished with destruction. On the eastern side the rainfall was 123 ins. per annum, of which 24 ins. fell in one month, and though it was much less on the western side, the route was traversed by two or three rivers which brought floods from their head-water —200 kilometres away—to swell the local rainfall, and carried away bridges and washed out banks on days of blue sky and sunshine. To the north was a dense jungle glorious with tropical flowers and foliage, but reeking with malaria; and the whole region lay in the yellow-fever belt of which de Lesseps and his engineers had had so fearful an experience in Panama a few years previously. The temperature in the summer months varied between 90° and 98° in the shade, and the nights were nearly as hot as the days; on the central part of the line mosquitoes and sand-flies were in such quantities that even native labourers had to work with their heads and faces covered. Finally, and very important for the contractor, earthquake shocks were frequent, and all work had to be so constructed as to have a reasonable chance of withstanding them.

Youth, and the spirit of adventure, rose to the occasion, but Pearson took no unnecessary chances. He had always been careful of the health and comfort of his men, and he saw at once that to house them properly, to provide pure water and clean food, and to have medical aid at hand was an absolute necessity if he was not to be beaten by disease. From the first his instruction books abound in injunctions to get forward with the houses and workshops at Rincon

Antonio—the relatively healthy spot chosen for staff headquarters—and to spare no cost in providing pure water. But no possible precautions could altogether eliminate these risks, and more than once yellow fever descended on the workers and took its toll. True to his principle of not asking others to do what he would not do himself, Pearson took his chances with the rest, and had sometimes to be almost forcibly restrained from exposing himself, as his staff thought, unduly.

His preparations were careful and elaborate, and the next eighteen months were occupied in laying out the work in detail, assembling the material, engaging the staff and workers, and providing accommodation for them. About 2,000 men were employed in the beginning, and the number was increased up to 5,000 as the work proceeded. Mr. Meldrum in his original report had expressed the opinion that the output of the Mexican peon was only about 25 per cent. of that of the British navvy, but Pearson's view was that with proper handling and supervision a good deal more could be got out of him, and in the end he paid a handsome compliment to his Mexican team. Whatever its efficiency as measured by English standards, it was the only labour to be had and the only labour that could have stood up against the climate and continued to do some work during the rainy season. Pearson and his staff had a happy knack of getting on with their Mexican workers, and for all the six years of this undertaking, he had no serious labour troubles.

The first six months of regular working (June 30–December 31, 1901) proved the work to be more formidable than had been expected at the beginning. It was an unusually wet season, which tested the line to the utmost. During the six months the traffic was completely suspended for thirty-three days by the washing away of the Sarabia and Tehuantepec bridges and by a serious landslide near Tehuantepec; and further interruptions amounting to 21 days had been caused by derailments on bad tracks. The engineers hoped to get the new bridges pushed on to completion before the next rainy season, but they were doubtful about the initial work for the Malatengo bridge, and proposed to lay a steel cable across the river with powerful hooks to catch and hold the floating tree trunks, and so protect the temporary trestle bridge. With derailments at the rate of one a day it was evident that the whole line would need relaying if it was to carry heavy traffic with safety. A large part of it was beyond patching; the sleepers were rotting: the openings (to carry off water) having only wooden supports, were liable to subside; there were more than 200 timber trestle bridges, any or all of which might be swept away by a flood. Many of the curves and gradients were dangerous for all but the lightest traffic, and the work in detail would not bear inspection. "I have never seen such a mixed lot of rails and fastenings as on this railway . . . different classes of fastenings are scattered promiscuously over the division. It is no uncommon thing to find two classes of bolts with nuts of different sizes on the same joint. I have very serious doubts whether any measure short of replacing the fish-bolts throughout the whole division will be sufficient to put the line in a satisfactory condition." So writes Pearson in his note-book at the beginning of 1902.

In fact the whole 190 miles of line needed to be reconstructed and re-equipped. Except for sand and earth collected from the immediate neighbourhood, the greater part of the line was unballasted, and most of the sleepers and rails were already showing signs of wear. Everything was deficient, and new and more powerful locomotives and many more ballast cars were urgently needed. All these essentials were provided in the next two years, and the work went methodically forward and with the least possible interruption to the daily service across the Isthmus provided by the former railway. Before the end of 1904 this service was increased and expedited, and an American who travelled by it at this time recorded his astonishment at the "impossibilities" which had been accomplished. He saw a solid railway as good as the best in most parts of his country, bridges of steel with the best masonry abutments, easy gradients, and embankments and cuttings that were to all appearances weather-proof. But he was specially impressed with the general cleaning up and the healthy and comfortable-looking appearance of the new town of Rincon Antonio which was growing up about the railway headquarters, and last but not least, with the great works that were going forward at the terminal ports of Coatzacoalcos and Salina Cruz.

These two ports were a large part of the enterprise, and in Pearson's mind the key to its future prosperity. Coatzacoalcos was a relatively easy problem. It lay on a broad navigable river with deep water except at the bar, where the depth at high tide was only 14 ft. It was only necessary to dredge a channel through the bar to the sea, and to confine the waters to this channel to make sure of a deep inner basin within. When thus confined, the force of the tides might be relied upon to do the chief part of the work of scouring. Accordingly two converging rock jetties were run out from each side of the river towards the sea, and a channel 328 ft. wide deepened to 33 ft. formed by dredging between them. The inner basin was dredged to the requisite depth, and it was now possible to construct wharves along the river-side at Coatzacoalcos—henceforth to be named Puerto Mexico —with deep water alongside. A mile and a quarter of wharfage and steel wharves were so constructed, flanked with warehouses 400 ft. long and supplied with all necessary appliances for loading and unloading. These operations presented no special difficulty beyond that of bringing material and providing labour, and were carried through without mishap, under the direction of Mr. R. Adam as engineer. When they were finished and the new town had been supplied with good drainage and pure water, and the filth and refuse of the old town cleared away, it was found that Coatzacoalcos no longer deserved its reputation of being the unhealthiest place on the Isthmus. It had become a cheerful and relatively healthy tropical port.

Salina Cruz, the terminal on the Pacific, where Mr. F. Adams was in charge as engineer, presented a more difficult problem. Here, to begin with, was only a wide open bay with a little shelter under the cliffs on its eastern side. This was extremely difficult to make in bad weather, and in certain winds could not be made at all. There was nothing to be done except, as at Vera Cruz, enclose an outer space with breakwaters and make an inner harbour by means of a dock wall running across the space thus enclosed. The engineers had a little help from the rocks on the eastern side, but on the opposite side had to build up from the bottom with rubble and concrete. There was more than a mile of breakwaters to build, and another mile and a half of dock wall to make the inner harbour. It was the usual work of dredging out and building up, handling immense blocks of concrete with giant cranes, and the details need not be repeated. There was only one serious mishap, and that was in September, 1902, when the place was shaken with earthquakes and a furious gale lifted concrete blocks as if they were cockle-shells and swept one of the Titan cranes into the sea. It was by a queer coincidence a crane that had been blown into the sea at Vera Cruz and subsequently fished up by its brother cranes. This time it was beyond salvage, and American papers, not always too friendly, reported that the contractor's losses were at least $500,000. This was an exaggeration, but the damage was considerable.

Salina Cruz, like Coatzacoalcos, had to be fitted with wharves and warehouses and the rest of the plant of a modern port. It was also provided with a great graving dock 666 ft. long, 72 ft. wide at the bottom, with a water-depth over the sill at low tide of 29 ft. Finally a new town was laid out on the hills above the port with drainage and water-supply, to meet the needs of a growing population. From the beginning of the year 1902 onwards the line had been more and more in a position to take heavy traffic; and while the ports were being completed, Pearson busied himself with the shipping side of the enterprise. For this he entered into an agreement with the American-Hawaiian Steamship Co. to run a regular service from New York to Coatzacoalcos, in correspondence with a similar service from Salina Cruz to San Francisco, the northern ports and Hawaii. This opened up the prospect of a profitable trade in sugar between Hawaii and the eastern American ports and the possibility of picking up fruit and other Californian products on the way. It also encouraged the development of the Isthmus and the neighbouring regions by providing a ready market for the mahogany, tobacco, rubber and other tropical products which they grew or could grow in abundance.

The conclusion of this agreement was a really remarkable feat. The Steamship Company were in the position of having a profitable Atlantic to Pacific trade via the Magellan Straits, and Pearson, who had had no previous experience of shipping, had to persuade them to abandon this comfortably established trade, and to venture into the new route. He spent several weeks in New York over the business, and had need of all the arts of persuasion and negotiation. The Company demanded a guarantee from the Railway partnership, and he showed his faith in the enterprise by giving it up to a certain limit. This clinched the matter, but it may possibly have occurred to the Company in the course of the negotiations that, if they failed to come to terms with this formidable Englishman, he was quite capable of starting a steamship company of his own. The negotiations took place in the New York office of the President of the Company, Mr. G. Dearborn, and at the end of them, Mr. Dearborn turned to Pearson and asked him where he had gained his shipping experience. His reply was " in this office."

The railway and ports were inaugurated with high ceremony on January 25, 1907, when Pearson and his wife entertained and provided special trains for 200 guests. President Diaz came with a party of Ministers and officials, opened the railway gates with golden keys, travelled across the line visiting and inspecting the chief works and station for two days, started the first cranes to unload the first ship bringing American merchandise to Puerto Mexico and the first ship bringing sugar from Hawaii to Salina Cruz. There were banquets, dances and many speeches. President Diaz paid a warm tribute to the Government's partner, Pearson :

> Portions of this Isthmus have been literally remade. Flourishing new towns with pretty and comfortable dwellings and contented inhabitants owe their existence to the energy and courage of Sir Weetman Pearson, whose name will endure and be held in honour in this historic region of Mexico long after the 80-lb. rails over which our party has glided so smoothly have become corroded by age.

Pearson, on his side, while warmly acknowledging the support he had had from the President, dwelt specially on the debt that he owed to his staff and workers. With the work accomplished, there was a certain pleasure in recalling "the early years when the management was thankful if a single day passed without bringing unexpected disappointments and difficulties," and in pointing to the prosperous future which now seemed assured.

To the end of his life he looked back on Tehuantepec as one of the greatest and most difficult achievements of his Firm, and the bare record of its various stages can do little justice to the unceasing struggle with nature, climate, and disease which it involved for himself and his workers. These were days in which tropical medicine was still in its infancy, and he had to work by a few common-sense rules for enforcing cleanliness and hygiene. But the strict observance of these on the scale that he enforced them was a novelty at that time and led the way to the more elaborate and scientific methods that were developed in the subsequent years.

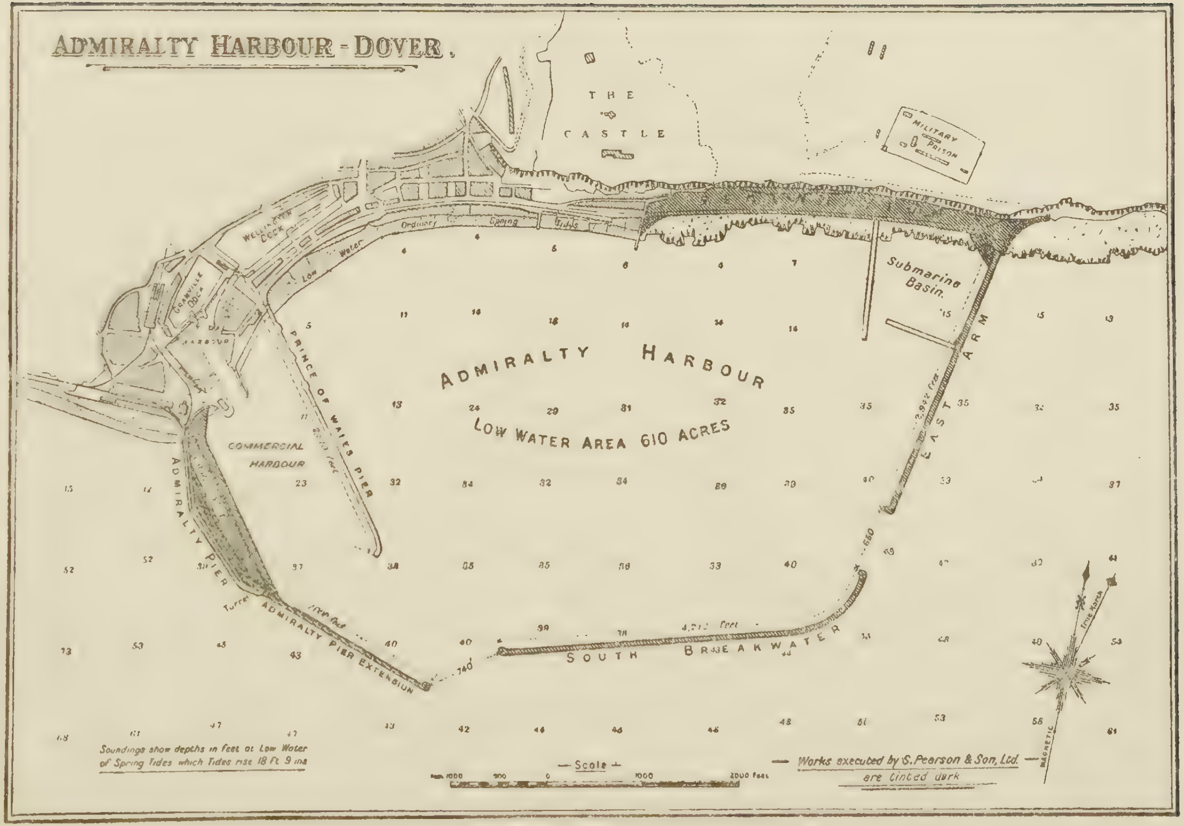
The commercial results when the line was opened not only justified but far exceeded Pearson's expectations. He had spoken of 600,000 tons as a reasonable estimate of the traffic it should handle; in 1909 the actual amount was 699,000; in 1910, 856,000; in 1911, 1,028,000. Then Diaz fell from power and Mexico was plunged into revolutionary strife and internal disorder, but under the Pearson management, and with Mr. W. B. Ryan as Vice-President and General Manager, the Tehuantepec Railway maintained its services uninterruptedly up to and including the first years of the war. Whether in normal times it could, as Pearson believed, have held its own with competent management against the competition of the Panama Canal was a question which, so far as he was concerned, was never tested. The Carranza Government considered the year 1918 a favourable moment for winding up the partnership, and the rescission was decreed by the Chamber of Deputies in October of that year. Patriotic Mexicans thought that so profitable an enterprise should not be permitted to remain in the hands of a foreigner; and some were chafing under the careful and impartial management which had made it profitable. The Government also was in need of cash and saw its way to it by selling the block of shares in the Shipping Company, which was part of the property. The Ministers who proposed the rescission explained that it would be "very advantageous to the Government because, in addition to yielding a good sum to the Government, it would put an end to the tyranny exercised by Pearson in Tehuantepec." When certain members complained that Pearson had been bought out according to the terms of his contract instead of being disposed of in the more summary ways then in favour in the Republic, the Minister excused himself by saying that "the Mexican Government could not act with Pearson in the same manner as with the landowners who were enemies of the Revolution because Pearson was backed by a great Power which had many Dreadnoughts and guns." Pearson, it need hardly be explained, had never invoked the assistance of the great Power or dreamt of being supported with Dreadnoughts and guns.

It was suggested subsequently that Pearson had shown great skill in winding up his partnership at the moment most advantageous to himself. There was no question of skill on his part or any initiative whatever from his side. He had never complained of any contract or sought to evade one on the ground that it was working out less favourably than he had expected. Had the Mexican Government been willing, he would loyally have gone forward with his Tehuantepec partnership, and faced whatever competition might have followed on the opening of the Panama Canal. But he had numerous other tasks on his hands, and it could scarcely have been disagreeable to him that the Mexican Government should wish to wind up the partnership after the period of greatest prosperity and before the expected competition had begun to make itself felt. What would have happened if the Tehuantepec Railway had remained under his management can only be a matter of conjecture; what did happen under Mexican management was that both railway and ports fell into disrepair and, in default of any serious effort to develop new business, were unable to stand up against the competition of the Panama Canal.

It is worth noting as a pointer to what was to come that from the very beginning the Tehuantepec locomotives burnt

SALINA CRUZ HARBOUR

oil brought from Beaumont, Texas. This was loaded into tank steamers and delivered at Puerto Mexico (Coatzacoalcos), where the Company had a steel storage tank of 1,500,000 gallons capacity, whence it was distributed to smaller supply tanks along the line.


ADMIRALTY HARBOUR - DOVER.
THE CASTLE
MILITARY PRISON
Submarine Basin.
EAST ARM
2,942 feet
ADMIRALTY HARBOUR
LOW WATER AREA 610 ACRES
PRINCE OF WALES PIER
COMMERCIAL HARBOUR
WELLINGTON DOCK
GRANVILLE DOCK
HARBOUR
Low Water
Ordinary Spring Tides
ADMIRALTY PIER
Turret
ADMIRALTY PIER EXTENSION
740
SOUTH BREAKWATER
4,212 feet
660
Soundings show depths in feet at Low Water of Spring Tides which Tides rise 18 ft. 9 ins
— Scale —
1000 500 0 1000 2000 feet
— Works executed by S. Pearson & Son, Ltd. — are tinted dark
True North
Magnetic

DOVER HARBOUR.

CHAPTER XII

DOVER HARBOUR

Dover Harbour A Naval Necessity—The Plan—Conditions at Dover—General Method Adopted—Pearson's Time-table—Preliminary Work—Running out the Staging—The Admiralty Extension—Work on the East Side—Making a Block-yard—The South Breakwater—Pearson's Resourcefulness—Buying Cement Works—And a Granite Quarry—Questions about the Design—Dover as a War Harbour—Its Future Uses.

However full Pearson's hands might be, he was always ready for a new job, provided it was big enough to be worth his time and thought. When it became known that the British Admiralty had at length decided to construct a great naval harbour at Dover, his mind was quickly made up that, whatever else it might be doing, his Firm must strain every nerve to get the contract to do this work, and long before the Government advertised for tenders, he had thought out its principal problems.

For several years before the end of the last century it had become evident that a properly constructed naval harbour at Dover was a necessity and an urgent one. Since the torpedo had come into use, the Downs were no longer safe shelter for a fleet, and were to be less and less so as the destroyer and the submarine were developed. As far back as 1844 a Royal Commission had reported in favour of substantial extensions, but naval opinions differed as to the form they should take, and nothing was done. In 1886 Sir William Harcourt, in spite of his known objections to expenditure on armaments, was prepared to allot £2,000,000 to a scheme, but the Government of which he was a member was short-lived, and the subject was again shelved until 1894, when Lord Spencer, who was then First Lord of the Admiralty, proposed another scheme. Finally in 1897, when Mr. Goschen was First Lord, this last scheme, with enlargements and new features which raised the estimated cost from

£2,000,000 to £3,500,000, was incorporated in a Naval Works Bill, and this having been passed, the Admiralty at once invited tenders. The bid of the Pearson Firm was the lowest, and it was awarded the contract with general approval. The designs had been prepared for the Admiralty by Messrs. Coode, Son and Matthews, and the work was to be carried out under their direction as Chief Engineers. The Firm's director in charge for the chief part of the work was Mr. Ernest Moir.

The position was slightly complicated by the fact that the Dover Harbour Board—a composite body on which the town, the Admiralty, the Board of Trade, and the Railway Company are represented, under the chairmanship of the Lord Warden of the Cinque Ports—had already embarked on a scheme for converting Dover into a Transatlantic port, and had obtained power to levy a poll-tax of a shilling (increased in 1903 to 2s. 6d.) on every cross-Channel passenger for this purpose. By 1897 it had already constructed what was known as the Prince of Wales's Pier, which ran seaward from the shore to the eastward of the Admiralty Pier, and was preparing plans for an extension of the Admiralty Pier and various other works, including a new water-side station. The much larger Admiralty scheme rendered the Prince of Wales's pier (see Fig. IV., p. 124) unnecessary for its original purpose of protecting the proposed new station and jetties, and it was taken over by the Admiralty and brought into its own scheme. In exchange the Harbour Board obtained a lease of the projected official extension of the Admiralty Pier to provide berths for ocean-going steamers, but remained free to complete its other plans, including the water-side station; and for these also the contract was given at a later date (1909 to 1911) to the Pearson Firm.

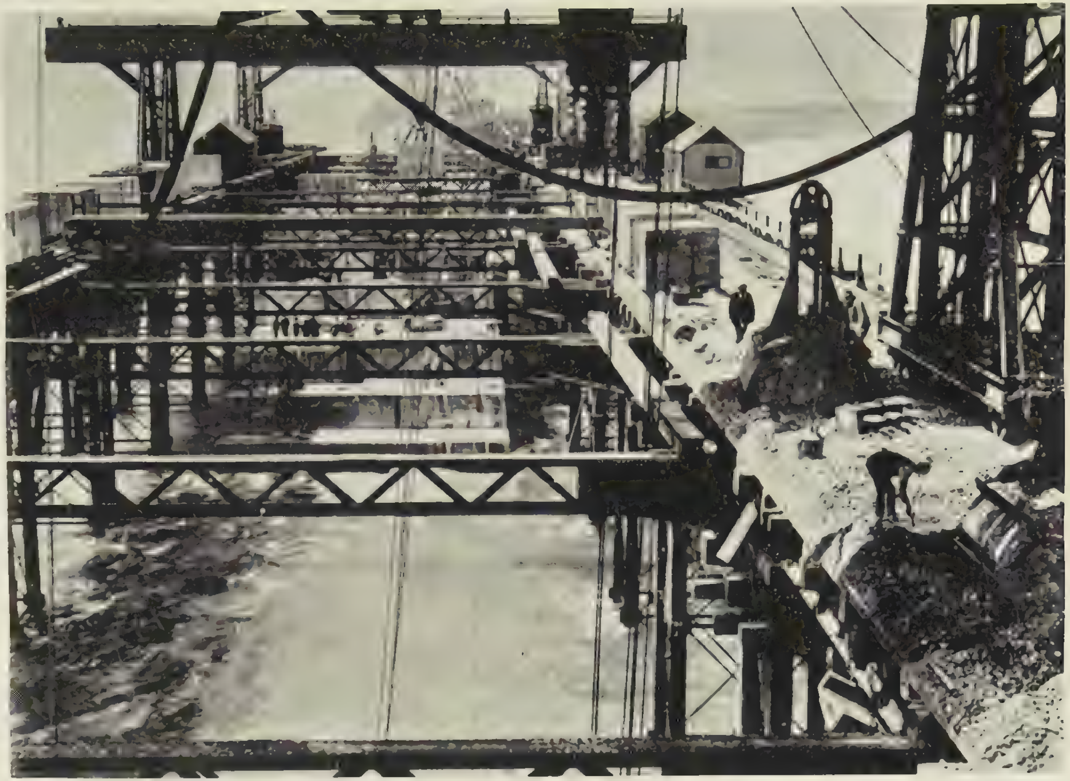
Though the Admiralty design was on a vast scale—in fact for the construction of the "largest artificial harbour in the world"—the general idea of it was quite simple. The new harbour was to be formed by three enclosing breakwaters: (1) an extension of the old Admiralty Pier for 2,000 ft. in a south-easterly direction; (2) an isolated breakwater on the south, 4,200 ft. long, curving towards the shore at its eastern end so as to be in line with (3) a breakwater, 3,320 ft. long, running out in a southerly direction from the base of the cliffs on the east side of the bay. The three breakwaters together were to enclose an area of 610 acres, of which 322 were to have a depth of at least 30 ft. at low water ; and the entrances to the harbour, 800 and 600 ft. wide respectively, were to be between the Admiralty Pier and the isolated breakwater, and the latter and the eastern breakwater. The foreshore between the Castle jetty (which runs out into the sea just below the Castle) and the eastern breakwater was to be reclaimed by a sea-wall, and powerful forts were to be erected for the defence of the harbour.

The conditions at Dover differed from those at Vera Cruz or any other great harbour that the Firm had constructed in that there was a bottom of hard chalk in which the foundations of the sea-walls could be laid. Instead, therefore, of dumping rubble and laying concrete blocks " at random " up to low-water mark, it was possible to build the walls vertically from bottom to top. This involved three processes : first, excavating the surface layer above the hard chalk and sinking into the chalk a few feet, then preparing and levelling the chalk foundation, and finally laying the concrete blocks of which the walls were composed on this foundation. The average depth at which the foundations were laid was 47 ft. below low water of spring tides, and in the deepest part 53 ft. Since there was a rise at spring tides of 18¾ ft., this meant that the average depth at high tide was approximately 66 ft. for the initial work of laying the foundations. For the completion of the wall there was another 11 ft. above high-water mark, apart from the promenade parapets, which rose 13 ft. higher on Admiralty Pier side and 9 ft. higher on the eastern side. Thus, if the water could have been drawn off when the work was finished, a spectator would have seen three immense perpendicular structures rising eighty feet into the air and about forty feet broad—one standing alone in the centre nearly a mile long, and the others running out from the shore to meet it, three quarters of a mile, and half a mile respectively. The east-west walls would have shown a paved apron of concrete blocks projecting from the walls at their base on the seaward side to protect them from the scour of the tides and down-stroke of the sea.

To raise such structures on dry land would have been no small undertaking, but four-fifths of this work had to be done under water on a site peculiarly exposed to strong tides and heavy gales; and, since the original Dover was cramped between cliffs and sea, land had actually to be reclaimed from the sea to provide a base for these operations. Pearson was all over the ground while he was preparing his tender, and when the time came to start work he had carefully thought out a special technique to suit the conditions. The chief part of the work was specified to be done by Goliath cranes mounted on parallel gantries or stagings of piles and spanning the space in which the breakwater was to be laid, but instead of the usual one Goliath, there were to be several for each breakwater, working, so to speak, in line ahead. The first was to build the stagings and work the grabs which would do the preliminary excavation of the surface layers on the bottom; the second to lower and raise the diving bells, each containing four men, who deepened and levelled the foundations; the third and fourth to handle the concrete blocks and to place them in position with the aid of helmet divers. Yet another was added to lay the blocks for the part of the breakwater which was above low-water mark when extra speed was necessary. This multiplication of giant cranes and the provision of the longer staging required to enable them to operate as each completed its work, seemed at the time to be rather an expensive method of working. But this method was specified in the contract, and, as the work proceeded, was more than justified by the precise division of labour that it ensured, and the saving of the delays which were inevitable when the same crane had to be adjusted to different kinds of work. With any other method progress would have been much slower.

The contract was signed early in 1898 and work was begun in the summer. A characteristic memorandum of Pearson's drawing up in the spring of this year shows how its various stages were schemed out in his own mind:

> Admiralty Extension: We should expect to be setting blocks well within one year from signing the Contract.
>
> With three Goliaths working day and night we con-



ADMIRALTY HARBOUR, DOVER
Construction of Admiralty Pier Extension

sider we can construct 300 to 400 feet of this pier a year. Calculating upon 300 feet a year, this means that eight years are required for construction under normal conditions, but to be safe say nine years.

East Reclamation Wall : We should expect to begin the concrete work within six months, and to complete the reclamation and have it backed up with chalk within two years.

East Arm : We should expect to have the root of this work connected by a Trestle Railway with the Eastern end of the parade well within one year, and to begin block-laying on the Eastern arm within eighteen months.

The whole of this work ought to be completed within seven years afterwards, making the total time eight and a half years.

South Breakwater : We should expect to have the temporary railway constructed, the first bays of the construction staging erected and the machinery fixed all ready for block-laying in two years.

On the average we should work four Goliaths for setting blocks, and should expect to get an average of 6,000 blocks a year, i.e., 1,500 blocks per Goliath or ten blocks a day of twenty four hours ; assuming we got 150 working days a year, this makes the total time for completion nine years, but to be safe say ten years.

As the new works progress we believe the difficulties of block-setting and preparing the foundations will be much greater than at the beginning of the work. Hence we are assuming that considerable night work will be necessary on the Admiralty Extension and South Breakwater to complete the work in the time specified.

Supplies and Blockyards : In all some 1,500,000 cubic yards of concrete are required, and during certain stages of the work 200,000 cubic yards will be needed a year.

On the average the Blockyards must be capable of turning out 4,000 cubic yards a week. A Blockyard with two Mixers turning out together 1,000 cubic yards a week is about the size we would suggest, and thus four Blockyards would be required in all.

> One would be in front of the Foreshore or at Dungeness.
>
> One would be at Rye or Sandwich, which is necessary to supply the blocks for the East Reclamation Wall at the first, and afterwards it would be continued as a yard for general purposes.
>
> Two Blockyards would be on the Reclamation site, which we consider is all there will be room for.

There were certain modifications in this programme as the work proceeded, but if the time-estimates were not fulfilled to the letter, it was only because alterations were made in the design causing suspension of work or additional work which in the end added two years to the period of construction. So far as Pearson was concerned, he was at all points within his time-table.

The first step was to reclaim the foreshore along the track of the South-Eastern Railway and convert it into a blockyard at the western end for making the concrete blocks required for the Admiralty Pier extension. These blocks were composed of cement, shingle and sand mixed, the material being brought by rail and mixed and run into moulds on the spot. There were larger and smaller, the larger being about 14 ft. long and 6 ft. high and weighing 42 tons. As the bricks are to an ordinary wall, so are these large blocks to the sea-wall, and the task of the marine builder is to handle them and put them in position. For this he needs cranes of corresponding capacity, and in order to support them and the trains bringing the blocks to feed them, he has to build up a temporary roadway from the sea-bottom and carry it out to sea along the path of the proposed wall. This roadway, though temporary, has to be immensely strong to support the weight of cranes and blocks and to be proof against tides and storms.

While the blockyard was getting to work, this temporary roadway was being run out from the end of the Admiralty Pier. Sets of six piles were driven into the chalk bottom at intervals of fifty feet on each side of the course of the new wall, and each was braced together with steel rods, and joined up with the group opposite by girders bridging the space between them. A staging supported by girders was then laid longitudinally over the piles, making a continuous roadway running seawards on both sides of the proposed breakwater. On both roadways there were double lines of rails, the outer to carry the legs of the Goliath crane and the inner the trains carrying the blocks to feed it. The crane when mounted was an immense steel frame spanning the water-space between the parallel stagings like a movable bridge, and its carrier running along its main girders took the blocks from the sidings and deposited them on the sea-bottom.

The piles were an initial difficulty. The woods ordinarily used were liable to insects, and, what was even more important in the busy cross-Channel port, they became a danger to shipping if by any mischance they went adrift. It was necessary, if possible, to find woods that would not float. After many experiments, in the course of which the Firm sent an expert to Australia, Tasmanian blue-gum, which is so dense that it sinks like a stone and is incidentally impervious to insects, was found to meet the case, and piles of this 100 ft. long and 22 ins. square, each weighing ten tons, were towed into position between barrels. Seventeen bays of staging were in use at one time, and as the breakwater was completed at the shore end, the staging was dismantled and re-erected on the farther side, pile-driving and stage-erecting machinery being kept for this purpose at the end of each completed section of staging. All this work had to be immensely strong to carry the blocks and the Goliaths, and to withstand the buffeting of wind and waves with that enormous weight imposed on it.

The Admiralty Pier extension went steadily forward without mishap. The foundations were excavated by the grabs and prepared by men in diving-bells, the blocks lowered by the Goliaths and placed in position and " joggled " (i.e. bonded together by putting bags of cement into cylindrical holes left for the purpose) by the bell divers. The orderly succession of these processes secured by using the three Goliaths justified all expectations, and though the diving-bells were working 66 ft. below the surface at high tide, the air-pressure was not dangerous, and the bell divers were able to work for three hours at a stretch. There had, in fact, been greater pressures of air in the Blackwall Tunnel. A ship collided with the staging and there were one or two minor accidents, but nothing except storms and sometimes strong currents interrupted the even course of the work, and the staging stood firm in the worst weather. Pearson himself kept constant watch, and happening to be on the spot during a great storm, and seeing the preliminary work threatened by the waves, he donned oilskins, and calling for volunteers, acted as foreman of the gang of workmen which successfully strove through the stormy night to prevent the wrecking of the staging and loss of the plant. Meanwhile the building of the sea-wall and the reclamation of the foreshore was begun at the eastern end of Dover. Here staging had to be erected parallel with the shore, and as many as fifty bays (2,500 ft.) were in use at the same time, but for this work the staging ran alongside the line of the reclamation wall, and the foundations being just above low-water line were all put in while the tides were low. As the wall was brought above high-water-level it was backed by chalk, excavated by blasting the adjoining cliff, and early in 1900 this process was so far forward that a blockyard could be erected on the space reclaimed. In order to bring the ballast required for this, it now became necessary to construct a four-mile railway from Martin Mill Station on the Dover and Deal Railway to the top of the East Cliff, where a bin holding about 1,000 cubic yards was filled from special Hopper-bottomed trucks. Decauville wagons, loaded from trapped outlets at the bottom of this bin, were then lowered down the cliff by a rope incline and run by hand along staging into the blockyard, where they were emptied into electric mixers. Six of these ran on separate sets of rails alongside and above the wooden moulds, and the same power that propelled them kept the mixers at work, so that, as far as possible, the liquid cement should be ready by the time it reached the mould assigned to it. From first to last, 52,000 blocks were made in the eastern blockyard, 18,000 for the east arm, 29,000 for the south breakwater, and 5,000 to form an apron for the protection of masonry from the sea where it was needed.

The reclamation wall staging had to be pushed forward to the base of the cliff on the far side of the bay before the east breakwater could start seawards from its "root-wall," and it was not till January, 1901, that a beginning could be made on that part of the work. The process was the same as on the Admiralty Pier extension except that two more bays (100 ft.) of staging were used on the east side and a fourth Goliath brought into action. Pearson's original belief that this part of the work would prove slower and more difficult was agreeably disappointed. Progress was now much more rapid, and the engineer reported in May, 1907, that although two years less had been spent on it, the head of the east wall was now in about the same state as that of the Admiralty Pier and should be finished at about the same time. This he attributed in large measure to the protection given by the Admiralty Pier extension against heavy south-west seas and strong flood tides.

There remained the south breakwater, which had to be built right in the sea and left isolated from its two neighbours. A gallant attempt was made to start it as an independent work with an iron staging built up from the bottom, but this was all demolished by a storm one night in September, 1903, and it became necessary to revert to the more patient method of prolonging the staging from the east arm, and so making a temporary viaduct across which the Goliaths and the trains carrying blocks could pass. When once this was accomplished, the rest was only a matter of time. During the last part of the work, there was a continuous railway from the west end of the east blockyard along the shore, over the east arm, across the viaduct and so to the west end of the south breakwater. This enabled the whole of that portion to be treated as one work, the southern breakwater being supplied with blocks from the east blockyard, and the Goliath cranes being moved forward as they were needed. The retreat, when the work was finished, was similarly across the viaduct to the shore; and finally, the viaduct was removed, and the south breakwater became the island that it now is.

If in each separate part, the work presented no special difficulties to the engineer and contractor experienced in harbour construction, its magnitude and the length of time over which it had necessarily to be spread were the highest tests of organizing ability. To get it completed within the time was, both from the Government's and from the contractor's point of view, of the utmost importance. During the period of construction, the political situation was heavily clouded, and there were at least three occasions when the possibility of a war in which a well-protected harbour at Dover might have been all but a necessity had to be considered. For the contractor the time-factor was always vital. If by mistiming any part of the work, he kept another part waiting, if the timber for the staging was not available as and when it was needed, or the cement blocks were not produced in numbers sufficient to supply the cranes, the work would have been stopped or delayed while the labour bill and the on-charges ran on. A very little miscalculation on any of these points might have wiped out the contractor's profits, but to calculate them nicely over a long period, and to run an even race with storms and tides which made it improbable that there would be more than 150 working days in any given year, required the utmost vigilance and experience.

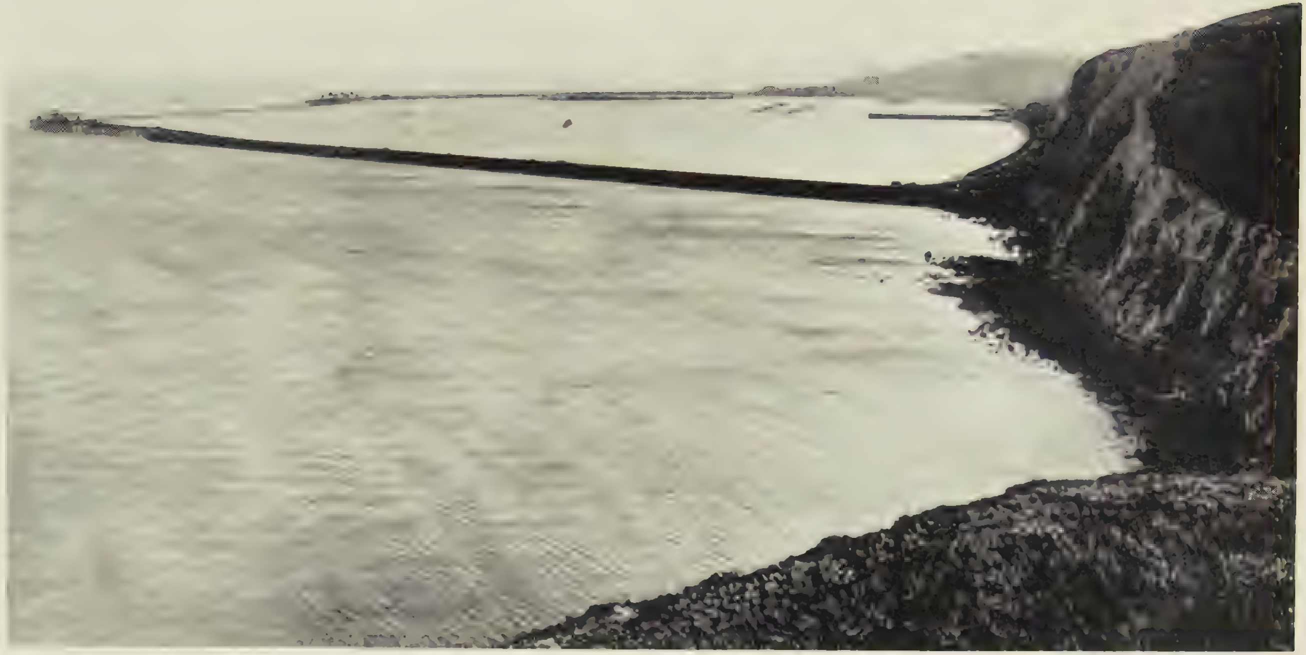
Having appointed his engineers, Pearson's rule was to trust them, and to interfere as little as possible in their work. In this way only could he have handled so many contracts at the same time. But when he sought this particular contract, the idea of having a great and important national work under his own eye and within a stone's-throw of his own home in Sussex, had greatly appealed to him, and from the first he took a special pride and pleasure in Dover Harbour. During the next eight years he was constantly on the spot himself, and his note-books and memoranda show how keenly he watched. He has his time-table in mind throughout, and knows at once if it is falling behind. He has his eye on what will be wanted in three or six months' or a year's time, and wants to be satisfied that everything has been thought of and ordered in advance. He is ready for all emergencies. When the price of cement is raised against him, he buys up the Wouldham Cement Works and boldly goes into the business of making cement for himself, and sells the works at a handsome profit when he has done with them. When a shortage of granite threatens, he buys a granite quarry in Cornwall and again produces for himself. Those who thought to take advantage of his necessities had always to beware of his counter-attacks, which were generally prompt and decisive. If he is impatient of anything it is of the red-tape ways of the Government Department worrying about trifles, and he begs that small disputes may be settled verbally and promptly. "I deprecated the voluminous correspondence," he reports himself as having written to an Admiralty official, "as it only led to friction, for, if we had a letter of complaint, we were bound to reply to it in self-defence. Any small complaints ought to be expressed verbally and they would be attended to. Of course, if we neglected to attend to them, he would be perfectly justified in writing, but I did not think it desirable that every little complaint should be put in writing." With all his care for detail, the practical man's instinct for getting on with the work and not worrying about trifles was strong in him.

As the work got near the final stage, criticisms of the Admiralty design began to be heard, and certain changes were made and new works added to meet them. The question of the design lies outside the contractor's part of the story, but a word may be said about it, since it still has its importance for Dover as a commercial harbour. The point at issue, which was raised rather sharply by an accident to the Red Star liner *Finland* in entering the harbour in 1908, and subsequently by the experience of certain warships, was (and is) whether the Admiralty Pier extension overlaps the south breakwater sufficiently to make the entrance to the harbour safe in certain states of the weather. A ship entering harbour has to slow down, and if she comes too suddenly into sheltered water, she may not have enough steerage way to prevent her stern being slewed round by the wind, or by strong currents at the mouth of the harbour, and her bows being driven into the breakwater. The way to prevent this is to extend one of the breakwaters seawards, so that a ship entering the harbour may do so at a sufficient speed to enable her to keep a straight course whatever the state of the wind, and also that she may have sufficient sea-room not to risk collision with either breakwater if she should momentarily be out of control.

It was alleged that the western entrance to the harbour between the Admiralty Pier extension and the southern breakwater was too narrow, and the Admiralty Pier not sufficiently extended, to satisfy these conditions, but no complaint was ever made about the east entrance—that between the south breakwater and the east arm. This proved safe and practicable for the largest ships at all states of the tide and weather. When the war came there was no question of the use and value of the harbour both as a shelter for the fleet against submarine attack and as a base of operations in the Channel. This was precisely the emergency for which it had been constructed, and during the four years it much more than justified the money and pains bestowed on it, and was, by common consent, an essential part of our naval equipment.

What of the future ? The traveller who passes through Dover on his way to the Continent sees this splendid harbour empty of shipping, and except for the small Channel packets almost unused. If he has forgotten the purpose for which it was built and which it served so well, he may comment caustically on the waste of the taxpayer's money. Certainly for the present, and the peace-lover will hope for ever, its naval and military uses are exhausted. There is no enemy within sight against whom it would afford protection ; our nearest neighbour could command it, if he chose, with his long-range guns. The Admiralty, therefore, has bequeathed it to the Dover Harbour Board, which, with its right of levying tolls on cross-Channel passengers, has the means of maintaining and developing it, if circumstances prove favourable.

Whether it will be developed depends not only on the Harbour Board, but on the Railway Company and the Shipping Companies. The original idea was that it should be not only a naval harbour but a port of call for ocean-going steamers, and for a short time it was so used. The depth of water alongside the principal quays and piers is sufficient for the largest steamers ; the eastern entrance is good in all weathers ; the western could easily be made so, if it were thought worth while. The landing and station accommodation is excellent for passengers ; the journey to London quite short. If coal and iron are developed in Kent, there should be a considerable new export trade. On the other hand, the Southern Railway has large interests in other ports,



GENERAL VIEW OF DOVER HARBOUR NEARING COMPLETION

and it may plead that Dover is too cramped between cliffs and sea, and has too little space for wharves and warehouses and new approaches by rail, to make any large expenditure of capital justifiable. It is certain that such a harbour would not have been built at Dover except for naval necessities, but having been built and being there, it is likely, as time goes on, to find commercial uses.

CHAPTER XIII

REVERSES AND SUCCESSES

A Cross-section of the Firm—Pearson's Caution and Courage—Some Disasters—A Great Western Railway Contract—A "Wet" Tunnel and a Heavy Loss—Malta Harbour—Striking a Fissure—An Unprecedented Flow of Water—A Controversy with the Admiralty—Seaham Harbour—Destruction of the Dock Wall—Pará Harbour—The Great Riverside Docks.

Before the end of the nineteenth century the business of the Pearson Firm was on a scale which made it more resemble the Works Department of a Government than a private firm. One day in November, 1899, Pearson sat down and drew up a list of the contracts on which it was engaged at that moment and sent it to his son Clive, then twelve years of age, whom he already designated as a future partner, when his education should have been finished. This is printed on the adjoining pages, and, with Pearson's own comments, presents a vivid cross-section of the history of the Firm. It will be seen that he says of the Tehuantepec Railway that it is "by far the most serious business that we have yet undertaken," and that "if I had nothing else to do I should be busy on that alone." He has, nevertheless, two great harbours on his hands, two considerable railways, half a dozen docks, waterworks and drainage schemes, and is planning a railway in China, which afterwards materialized as the Taoku-Chinghua Railway constructed for the Pekin Syndicate. In the next three years he added the great Salina Cruz Harbour works in Mexico, the docks and breakwater in the Malta Harbour and numerous other minor works in England, Ireland and Mexico. And at the same time he started on the greatest and most daring of all his enterprises, the search for oil in Mexico, which, if anything in the world, might have taken a man's whole time.

This to Pearson was life. He had by now a great fortune and a prosperous and splendidly organized business, which would have yielded him all the wealth he needed with the minimum of exertion, if he had been so disposed. But money for its own sake was only a small part of his needs ; what he loved was engineering, constructing and prospecting, and in proportion as he succeeded he felt the greater necessity to break new ground, to take larger risks, and to do what others had failed to do. Among men of his calling he was probably unique in combining the caution and grasp of detail characteristic of the expert with the daring of the pioneer, and the two things in combination accounted for his success. With this equipment he was able constantly to launch out into new schemes without losing touch with the old, and there was probably no time when he did not carry in his head a cool estimate of the earnings and liabilities of his firm and have clearly in his mind the limit within which he could afford to take risks. The Firm, the original contracting Firm, always stood clear of all other entanglements, its capital values being constantly written down and all its assets most cautiously valued. He was thus able to say when his fortunes looked blackest in the Mexican oilfields, and he had embarked between two and three millions sterling without any assured prospect of return, that he could turn his back upon oil and write off all his losses without in the least affecting the fortunes of the Firm. He had deserved the reputation of being a skilful financier, as, indeed, a contractor on the great scale has need to be. But his credit rested not on any skill in manipulation but on the careful and cautious conduct of his business down to the smallest detail.

The wealth and prosperity of the Firm bear their own witness to the success with which Pearson handled the great majority of his contracts. But in the course of his life he had some serious disasters, and a few instances of these may help to show the risks and vicissitudes of the contractor's business. A contract which for years caused him incessant trouble and anxiety was that concluded with the Great Western Railway in 1897 for the construction of the line from Wootton Bassett near Swindon to Patchway on the South Wales line between Bristol and Newport. The large

Name of Contract.	Manager.	Amount of Contract.	No. of men employed.
Admiralty Harbour, Dover ..	K. Macdonald	£3,300,000	2,000
Granite Works (quarry), Cornwall	E. E. Pearson	—	400
Cement Works, London ..	E. E. Pearson	—	400
East London Waterworks, London	E. E. Pearson	300,000	1,000
Surrey Commercial Dock, London	E. W. Moir	400,000	1,000
Great Northern and City Railway, London	E. W. Moir	2,000,000	1,500
Seaham Harbour Company, Durham	T. L. Walsh	350,000	1,000
Great Western Railway, Gloucestershire	G. Hay	1,000,000	3,000
Port Talbot Docks, South Wales	J. Davies	—	200
Vera Cruz Harbour, Mexico ..	J. B. Body	2,000,000	4,000
Main Drainage, Dublin	B. C. Cass	100,000	500
Ross and Wicklow Railway, Ireland	F. T. Hopkinson	100,000	500
Tehuantepec Railway, Mexico ..	J. B. Body	2,500,000	4,000
Railways in China	—	—	—

Besides the above, we have other contracts that are not at presen

CARRYING OUT, NOV. 1899.

MEMO. PREPARED FOR CLIVE PEARSON.

REMARKS.

Breakwaters to enclose 1 square mile of deep water. A Harbour f safety for H.M. ships. The walls of Breakwaters are 60 ft. thick nd 80 ft. high. Work difficult. Contract time 9 years.

This quarry was bought to supply Dover with the granite facing equired for the concrete blocks, with which the breakwaters are uilt and which weigh from 20 to 40 tons each.

These works were bought to supply Dover and our other contracts ith cement. They are being extended so as to make 2,000 tons of ortland Cement a week.

The contract is to construct 2 Reservoirs to store water in winter eady for use in summer. They are about as large as our park at addockhurst. They supply East London with water.

We are here making an old dock, built 100 years ago, into a modern ne. The size of ships has so largely increased that old docks are useless.

This is a railway 3 miles long, all underground, running from insbury Park Station to the City (Moorgate Street). It is lined with on plates instead of brick.

This is a new harbour and also making an old dock into a new one r the Marquess of Londonderry, who requires them to load his coal nto ships.

This is a very heavy railway. There is a tunnel 2½ miles long nd a short one, besides 3 heavy viaducts. There are 47 locomotives eing used. This runs through Badminton.

This is nearly finished after 4 years' work. The docks are required r the shipment of coal, to foreign ports principally. They can load 2,000-ton ship in 1 day.

This is a large harbour for the Mexican Government, and is now robably the best harbour in North America. Have been at work years, and will take 2 to finish.

This is a contract that B. got and is just starting. It is for the tfall works of the sewers of Dublin and is a very pretty job.

A railway some 12 or 16 miles long, I forget which, of no particular fficulty or importance.

This is the lease of a railway 200 miles long between the Atlantic d Pacific Oceans and also for the construction of 2 ports. The lease for 50 years, and is by far the most serious business we have ever dertaken. If I had nothing else to do I should be busy on this alone.

This contract is all settled, but the Company are not yet ready to art operations. They will be this year, when we begin the making some 200 or more miles of railway.

y to start but which require watching and thinking about.

(Signed) W. D. PEARSON

increase of traffic which had resulted from the opening of the Severn Tunnel had made this line a necessity and raised a strong hope that it would also be an economy. By avoiding the southward curve through Bath and Bristol, it took eleven miles off the journey from London to South Wales (and 26 miles off the route via Gloucester), and, even more important, by avoiding the Wootton Bassett bank and the steep approach to Box Tunnel, it so improved the gradients that the same engine was expected to draw twice the load over the new route as over the old. With junction loops connecting with the Midland Railway near Yate, and a V-shaped junction at Filton near the point of contact with the South Wales Railway, one arm bearing Bristol way and the other towards Newport, it opened up a variety of new routes and connexions which promised and proved to be of the utmost value. But though only 33½ miles in length, its construction was by no means simple. There were four considerable viaducts, the largest 250 ft. long and 71 ft. high, 100 bridges of various kinds, and three tunnels, one of them 2½ miles long, straight through the Cotswolds between Acton Turville and Chipping Sodbury. The last proved to be a much more formidable undertaking than either engineer or contractor had supposed. Its seven shafts (one of them 280 ft. from the surface to formation level), its heavy cutting through hard stone or marble, and the forty different faces from which the miners worked were all in the day's work, but not the flow of water which wrecked the time-table and compelled the contractor to construct an arched tunnel below the track to carry it off.

Pearson stinted nothing to make a good job of it, but when the work was done, he calculated that he was actually out of pocket to the extent of £312,000, and that if the contractor's profit was added, his loss would be £457,000 after five years on an exceptionally difficult job. The Chairman of the Company acknowledged that his work had been " excellent throughout and had resulted in putting the Company in possession of a first-class line," but the Company disclaimed any responsibility for the contractor's loss. The case was taken to arbitration, as provided in the contract, Sir Benjamin Baker being sole arbitrator. The main question to be decided was whether the inrush of water into the tunnel was part of the contractor's risk, or a circumstance not contemplated in the contract, for which the Company was liable to make an extra payment. Pearson contended that the contract had been drawn on the assumption that the tunnel would be a " dry " one, in the well-understood sense of that term, whereas it had turned out to be a wet one. Sir Benjamin Baker substantially upheld this contention and awarded the contractor £233,000, and reserved another £160,000 for the decision of the Court on points of law. There followed a long and tiresome litigation, with appeals and counter-appeals, some of which were taken to the House of Lords, but in the end the points of law were decided against the Firm, which accordingly suffered a heavy loss on the contract. Pearson thought that he had been treated with scant consideration over this business, and never again tendered for any work on behalf of this Company.

Yet another difficult and disappointing contract was that for the new works in Malta Harbour, undertaken for the Government by the Firm in 1901. This included the construction of two new docks at the head of the French Creek in Valetta Harbour, one a double dock 790 ft. long with a caisson in the centre, the other a single dock 550 ft. long ; and also (under a separate contract) the construction of two breakwaters at the mouth of the harbour. These breakwaters were twice in the course of their construction seriously damaged by storms of hurricane violence which twisted and broke up the staging and iron piles on which it was carried as though they had been matchwood. This was a fair contractor's risk, and Pearson made no complaint about it. But a serious question arose about the docks. In the course of the excavations several fissures were struck and sea-water poured in through them at an average rate of over 32 million gallons a day for 15 months, and on some days reached a maximum of 45 million gallons. The amount was absolutely unprecedented, and far exceeded what had been encountered in the construction of the Severn Tunnel, which, till then, had presented engineers with the most formidable water problem on record. A powerful and very expensive pumping plant had to be specially installed to deal with it, and the completion of the work was held back for more than two years. At the end the Firm had found themselves over £265,000 out of pocket, for which the Admiralty refused to reimburse them.

In general Pearson was a good loser and made no complaint when he thought he had been fairly caught out by ill-luck or faulty estimates for which he had accepted the responsibility. But on this occasion he thought that the wholly exceptional circumstances entitled him to some consideration, and he believed that the Admiralty itself had, by dredging and blasting outside the dam enclosing the site of the new docks, destroyed the impervious clay blanket on the bottom and opened an underground channel through which the water passed into the docks. He therefore decided to take the case to arbitration by the Director of Works of the Admiralty (Sir Edward Raban), as provided in the contract. The arbitrator held the Admiralty blameless and decided that there was nothing in the circumstances to relieve the contractor from the stipulation in the contract that " no omission on his part to obtain reliable information " was to absolve him from " any risks or from the entire responsibility for the fulfilment of the contract." When penalized for delay Pearson had pleaded that here too the Admiralty was largely responsible, since in one portion of the works it had forbidden blasting and compelled him to have recourse to the much slower process of excavation without the use of explosives, but on this point also the arbitrator found for the Admiralty on the ground that the discretion of the Superintending Civil Engineer had been expressly reserved in the contract. Under pressure, the arbitrator consented to state a case on certain points of law, but the questions of fact having been decided against him, Pearson was advised that the points of law offered him little prospect of relief, and he dropped the case and submitted to the loss.

A minor work which, nevertheless, involved Pearson in a good deal of personal worry and anxiety was the contract for Seaham Harbour on the coast of Durham, undertaken for the Seaham Dock Co., which was chiefly the Marquess of Londonderry, in 1899. This is one of the few examples of a lump-sum contract in the history of the Firm. Accepting all risks, including the risk of faulty design, it undertook to make a deep-water channel, to construct two piers or breakwaters, and a wet dock, within four years for a total sum of £378,000, with a penalty of £200 a week for failing to complete within the time. On a rocky and often storm-bound coast, the work proved to be a good deal more difficult than was expected.

When the two breakwaters had been partly built and the dock completed and in use through a temporary entrance, a violent storm destroyed the whole eastern wall of the dock. This wall was of the type known as a stilt wall, the bottom part of it being a narrow facing to the limestone rock, and the whole being built in Portland cement concrete faced with stone. It was supposed that the pounding of the seas had loosened the seal between the narrow facing and the limestone. The seas during this storm were of extraordinary violence, and at Tynemouth were measured 36 feet trough to crest. At Seaham, standing on the inner dock wall 570 feet from where the seas struck the outer wall, the impact of every sea could be felt by the feet. The wall had to be rebuilt in a much more solid fashion, and Pearson found himself £50,000 out of pocket in the end. This was a fair risk under the contract and he made no complaint about it. He had, at all events, gained valuable experience in the always difficult task of building sea-walls on rock foundations.

A few details may be added here about certain other great contracts undertaken by the Firm during the next ten or twelve years. In the year 1906 it started on the construction of the new harbour at Pará in Brazil, a formidable work which took five years to complete. Belem de Pará, to give it its full name, the city on the right bank of the River Pará, which, by backwater channels, is the navigable entrance to the River Amazon, had become an essential outlet for the rubber of the Amazon Valley ; but its wooden wharves and the shallow waters beside them were unapproachable by ocean-going steamers, which had to lie out in the river and discharge into lighters. The problem was to build a solid wall out in the river, to deepen the channel beside it, and fill in the space between it and the shore, so as to provide sites for custom-house and bonded warehouses on the land reclaimed. Several dredgers capable of dredging 46 ft. below water-level were built by Lobnitz of Renfrew, and brought out from England for this purpose; and these had to be kept at work and the blocks for the wall laid in a tide which often ran at four and sometimes at six knots an hour. There were poisonous snakes in the river, and the water was so murky that the divers could see nothing and had to work by feel. Brazilian labour under English leadership was mostly employed, and the work went forward without interruption or mishap to its completion in 1911, when Pará had been converted into a well-equipped modern port.

The Pará Harbour scheme, of which Mr. Thomas Thomson was the engineer in charge, is specially interesting as embodying one of the earliest systematic efforts to combat tropical disease. The workers camp was pitched outside the town, the site having been carefully drained and all measures taken to keep it free of mosquitoes. A strict veto was then imposed on sleeping in the town and remaining in it after dark. This was not always easy to enforce, for Pará was a lively place and the risk of infection at first seemed slight, but experience proved that those who broke the rules did so at their peril. In the end the reclamation of the foreshore, which was part of the scheme, went a long way towards banishing yellow fever, and Pearson left Pará a much healthier place than he found it—a not infrequent result of engineering enterprise.

Another type of work which the Firm undertook on a large scale in the early years of the century was the construction of great river-side docks to meet the needs of modern shipping. Starting in 1901, they constructed at Liverpool a branch dock 880 ft. by 247 ft., a graving dock 630 ft. by 80 ft., and a river wall 770 ft. long in front of them. Four years later they started on a still greater undertaking at Hull, and there constructed the largest dock on the east coast north of London, and incidentally the first to be equipped with electricity for motive power throughout. The main basin of this dock, which was opened in 1914 by His Majesty King George, was 1,000 ft. by 1,050 ft., and it had two large arms to the north-west and north-east, 1,350 ft. by 325 ft., and 1,356 ft. by 450 ft. respectively. The entrance lock was 750 by 85 ft., and the depth of water was a minimum of 31 ft., rising to 38 ft. at high spring tides. This dock is still the best equipped coal-dock in the country. Both the Hull and the Liverpool undertakings were in the charge of Mr. (now Sir) Frederick Hopkinson, who carried them through with complete success. Finally, in 1912, they began the extension of the Royal Albert Dock in London, and carried on the work till the war broke out, when it had to be suspended. This dock was afterwards completed by the Port of London Authority.

The construction of a river-side dock presents no great difficulty to experienced engineers, but it requires good judgment and careful handling at all points. Even with modern mechanical appliances, the excavation of great spaces more than a thousand feet square to a depth of 38 feet is a formidable operation requiring a great deal of labour. As soon as the underground water-level is reached, pumping has to be continuous, the inflowing water being raised from timber-lined sumps sunk below the lowest foundations, so that the dock walls and sills of the locks or entrance may be built out of water from the bottom. The dock walls have to bear the full pressure of the quays behind them when the dock is completed and before it is filled with water, and their foundations, which are some feet below the bottom of the dock, need a great variety of treatment, according to the nature of the ground. The walls are generally composed of cement concrete faced with brick and granite or hard stone coping, and in tidal waters they have to be raised to some six or eight feet above high-water mark. In constructing the locks or entrances, the space has to be enclosed by either a timber sheeting or a coffer dam thrown out into the river and the water pumped out before the work begins. Mr. Hopkinson showed great ingenuity in the construction of these dams to meet varying circumstances.

Borings were generally undertaken by the Port authorities to ascertain the nature of the strata on which the dock walls were to be founded, but it was stipulated in the specification that these were only indications, and the chance of coming on sand or silt charged with water where gravel, clay, or firm sand had been expected was the contractor's risk. To avoid disaster in these emergencies needed constant watchfulness and good judgment in the choice of methods and materials. The Pearson Firm was not infallible, and it has suffered its reverses, as has been shown in this chapter, but it reduced these mishaps to a minimum, and gave workmanship and material which has stood the test of time.

CHAPTER XIV

EXPLORING FOR OIL

Oil in Mexico—The First Suggestion and Prompt Action—Delays and Disappointments—The Pouring out of Money—A Refinery without Oil—An Estimate of the Position—Selling Arrangements—Two Anxious Years—The Dos Bocas Well and its Fate—Laying Pipe-lines—An Ingenious Device—Forming the Mexican Eagle Company—The Turn of the Tide—The Great Potrero No. 4—A Struggle with a Wild Well—The Fire at the Potrero Wells—Progress and Profit.

On his way back from Mexico in April, 1901, Pearson missed his connexion at Laredo in Texas, and had to " stop off " at that place for nine hours. He found it wild with excitement about oil, for in February of this year the famous Lucas Gusher well had been drilled at Spindle Top, and would-be prospectors were rushing to lease lands all round and even hundreds of miles away from that spot. What he saw sent his mind back to a report made to him by one of his surveyors that a seepage of oil had been found on land granted as a subvention to the Firm at a place called Pedregal. Within a few hours he had both cabled and written to Mr. Body, instructing him to secure an option on all the land he could in the neighbourhood of San Cristobal on the Isthmus of Tehuantepec, where another seepage had been observed. Some part of his intention at this stage was no doubt to provide a local supply of oil for the locomotives of the Tehuantepec Railway, but from the beginning his thoughts took a wider range.

In the few hours at Laredo he studied all the prospectuses he could lay hands on, and gleaned from them the general conditions of what was to him a new business. His instruction was the comprehensive one to " secure option not only on oil land, but all land for miles round." " You will see," he says in his letter to Body, " that oil deposits frequently extend over big areas, so the oil rights must extend over a large district to be really valuable. Ten, twenty, or forty thousand acres appears to be no uncommon size—so in getting the option, get it over as big a country as possible. A short option is no good. We must have it for a year at least—preferably two, as it would take time to put down an oil well or otherwise prove it." His final injunction is to "move sharply, and be sure that we are dealing with principals." All this in the nine hours of his "stop-off" at Laredo on April 19, 1901.

Mr. Body went to work at once, and wrote two days later to New York, where Pearson had now arrived, advising the purchase of other lands besides those that Pearson himself had proposed. "By all means," was the answer, with further advice to be as quick as possible in securing absolute titles. The next step was to ask Capt. Lucas, who had been the first man to put down a well at Spindle Top in Texas, to inspect the Firm's subvention lands on the Tehuantepec Isthmus and report on the oil possibilities. As the result of his report, wells were drilled at several different points on the Isthmus, and the promising San Cristobal-Capoacan field was opened up for development.

Then followed a long and anxious period in which the expenditure outran all estimates, and the production of oil in any paying quantities seemed to be a distant and fading prospect. It was one thing to strike oil, and quite another to bring it to the surface under control, to refine it and to convey it to market. Months of labour might be wasted by an accident in drilling; much expensive drilling might produce no result, and even good wells might be exhausted and millions of gallons spout aimlessly into the air, or, still worse, catch fire and cause widespread destruction, before the flow could be brought under control. All these and many other vicissitudes, including political and revolutionary troubles which spread to the Isthmus of Tehuantepec, Pearson had to face and meet during the next few years, and for a large part of the time he found himself fighting for his life with competitors who saw their valuable monopoly threatened by his success. Hitherto he had been a professional among professionals, but in this field he was a new-comer and an amateur buying his experience as he went along, and pitting his brains against those of the most seasoned and determined exploiters on the American Continent.

He was carried through by his unquenchable belief in the value of his properties, but there were times when he was near giving up. In the year 1902 he told the present biographer that he meant to put a million and a half of money into oil, no more and no less. If when that amount was spent he had failed to make good, he would " cut his losses and clear out." When the stake was a great prize which with a little more or less might be won or lost, it was not his way to give up and come out, and it is evident from the records that the million and a half had to be at least trebled before success came in sight. " The amount of money we have spent on this oil business is becoming serious," he writes in September, 1904, three and a half years after the nine hours at Laredo ; but it was just then that the San Cristobal-Capoacan wells were beginning to look promising, and fifteen months later he decided that they were producing enough to justify the erection of a refinery and the provision of tankage at a further cost of more than £500,000. The site chosen for the Refinery was at Minatitlan on the Coatzacoalcos River, about twenty miles from Puerto Mexico, as Coatzacoalcos, the Atlantic terminal port of the Tehuantepec Railway, was now called, and in the first instance a small experimental Refinery was erected to ascertain the best method of refining. A year later and with the aid of the knowledge thus gained, the Refinery proper was begun, but it was not till the beginning of 1908 that the fires were first lighted under the stills. One thing led to another, and a standard gauge railway some eight miles in length had next to be constructed to connect these works with the Tehuantepec Railway and to obtain connexion with the general railway system of Mexico. Before that point was reached, seven years had elapsed from the beginning of operations.

But though the expenditure mounted up, Pearson extended instead of curtailing his operations, and doubts about his original leases and holdings only made him the more anxious to obtain new ones. In 1906 he obtained concessions from the Federal Government of Mexico and the Governments of the States of Vera Cruz, San Luis Potosi, Tamaulipas, Tabasco and Chiapas for the exclusive or preferential rights to explore for and work for oil on all the National State and vacant lands within those States, with certain limitations as to areas in two of them. These concessions were for fifty years and carried exemptions from taxation. A memorandum dated March 1,1906, shows his estimate of the position at that date:

> Our oil-fields are situated in the States of Vera Cruz, Tabasco and Campeche, Mexico.
>
> We own about 600,000 acres of land in the oil country and have royalty leases for 200,000 or 300,000 acres, which we have been four or five years in securing.
>
> We are drilling four distinct fields. Our field forty miles from Coatzacoalcos produces first-class oil, as will be seen from the analysis and report of the fractional distillates. Our Refinery Manager is drawing up details of the first instalment of the Refinery we intend putting up with all speed. His first instalment will have a capacity of 4,000 barrels of crude oil per day, or say 500 tons a day, of which 300 tons, or say 2,000 tons per week, will be benzines and kerosenes.[1] We are hoping to get this Refinery at work before the end of the year, and after working it for three months, we intend increasing it with all speed to 12,000 barrels a day; thus, by the end of the next year, we expect to have 6,000 tons a week of naphthas and illuminating oils to sell. As the total consumption in Mexico at the present time is under 50,000 tons a year, this means that we should have a minimum of 250,000 tons of such oils a year to dispose of outside of Mexico.
>
> We have acquired extensive river frontages and some 800 acres of land at Minatitlan for the Refinery. The climate is better there than at Coatzacoalcos, although only twenty miles from the coast, and the river is navigable, or if not will be made so, for vessels drawing 23 ft. or 24 ft. The load could be completed at Coatzacoalcos whenever necessary.

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[1] This estimate proved to be unduly sanguine. The proportion of benzines and kerosenes to crude turned out to be 40 per cent. instead of the 60 per cent. which seems to be suggested here.

> A 6-in. pipe-line is now being delivered to connect the oil-field with Minatitlan, and storage tanks are now being shipped for erection there.
>
> We expect before July 1st to be in a position to deliver crude oil to steamers. This oil on account of the great quantity of benzine it contains is not suitable for fuel.

With these prospects, and the Refinery well on the way, the time seemed ripe to consider the selling arrangements, and Pearson proceeded to set up a commercial department for this purpose in the London office of the Firm, and at the same time entered into an arrangement with Messrs. C. T. Bowring and Company, who were large distributors of oil in Great Britain, to buy the refined oils from the Mexican Refinery. At a later date the Firm purchased the petroleum distributing business of the Bowring Company and made it part of their own organization. These arrangements appear to have been a little too sanguine, for in July of the following year (1907) Pearson expresses his concern at the delay in bringing in new oil-fields. Although drilling had been continuous, no other field than the San Cristobal-Capoacan had been discovered till then. But having embarked on the business of selling and distributing, the Firm was obliged to get oil, and towards the end of 1907 it entered into an agreement with the Oil Fields of Mexico Company to purchase from that Company a minimum of 2,000 barrels and a maximum of 6,000 barrels of crude oil a day for twelve years.

This required more expenditure. The Oil Fields of Mexico Company had recently brought in a new oil-field (known as Furbero) some fifty miles inland from Tuxpam on the coast of Northern Vera Cruz, but before this could be made available it was necessary to lay a pipe-line of fifty-four miles from the field to Tuxpam and construct a narrow gauge railway for the conveyance of material to the field. The Firm agreed to advance the money for this purpose, but owing to the nature of the country and other difficulties, the work took so long that it was not till May, 1910, that the first cargo of oil was shipped from Tuxpam for delivery to the refinery at Minatitlan. In the meantime, Pearson went ahead with the provision of tank steamers, and the first of these, of 3,000 tons capacity for distribution round the Gulf of Mexico, was completed in 1907.

By the end of 1907 the Firm had embarked over £1,000,000 sterling on these enterprises, and Pearson estimated that another £600,000 or £700,000 would be needed before the profit-earning stage was reached. "If it is not then a proved success," he comments, "the position will be serious." Some of his anxieties may be read between the lines of a letter addressed to his son, Clive, in March, 1908 :[1]

> So far I have been occupied to the full. Matters not only of policy but of detail have kept me going at top speed. And, judging from matters yet to be done, I shall be kept occupied to the last moment, and even then I shall not be able to leave a clean slate behind me.
>
> I find things about as I expected ; not much better (except on the Railway), nor much worse. The Refinery is going to be lighted up this week ; not of course in full blast for the one-third unit, but still by still. It looks an immense place. Minatitlan market rivals Tehuantepec now. San Cristobal oil-field is in first-class shape. All the tanks are full of oil, and of course the pipe-line is in working order. I am afraid the area of the field has been determined, as we have got a complete ring of dry wells round it except for say one-eighth of its circumference. It may be, and we are so hoping (although not very hopefully), that the productive area will extend in that direction. The field only gives us a two years' life ; but surely before that two years has passed we shall have found further deposits of a satisfactory quality, i.e. a refining quality. The one encouraging feature about the oil-field is the fact that one well has continued to flow about 100 tons of oil a day for ten or twelve weeks. Such vitality shows that we may have a much more lasting field than the depths of oil-bearing sands and rocks have led me to believe.

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[1] The letter is dated, "On board stern-wheeler *Eagle*, on lagoon and canal *ex*-Tampico to Tamiahua *en route* by sea (or fresh-water, rather) and land to Tumbadero and Tuxpam."

As you know, we hedged by agreeing to purchase from Furbero a minimum of 2,000 and a maximum of 6,000 barrels a day for twelve years. So if we do fail to find more oil (which is an almost impossible assumption) than we have we avoid a failure. All this you know already, but it is cheering to put it down on paper when disappointments are all round me.

The oil business is not all beer and skittles. Far-seeing provisions have to be made to ensure success. Wise principles have to be followed. Much detail should hour by hour be gone into to avoid all waste. Everyone, on an oil-field that has been proved, is naturally inclined to be extremely wasteful as it is considered to lead to untold wealth. And beyond all, it is essential to know the business, otherwise the opinions of one's employees have to prevail. (And how disastrous this is to any business is readily realized when a moment's thought shows that it requires the concentrated effort of the trained man who is somewhat of a genius in his own trade to succeed.) I entered lightly into the enterprise, not realizing its many problems, but only feeling that oil meant a fortune and that hard work and application would bring satisfactory results. Now I know that it would have been wise to surround myself with proved oil men who could give advice that their past life showed could be relied on, and not, as I did, relied upon commercial knowledge and hard work coupled with a superficial knowledge of the trade. However, all's well that ends well. And I feel we are out of the wood in any event, and should we have plenty of oil in our lands we have a great business, one that my sons will be proud of.

I am expecting to find this trip very interesting. We are going through a highly petroliferous region. Many pools of oil are on the surface. But the oil is thick and heavy—almost too thick to convey by pipe-line. On the other hand, it contains from 5 to 10 per cent. of paraffin wax, a very valuable product.

The letter breaks off at this point and was not sent, but he kept it among his papers, marked "never finished" in pencil on the first page.

If he had found things "not much better than he had expected" in March, 1908, they were undeniably very much worse during the next two years. The Waters Pierce Oil Co., the subsidiary in Mexico of the American Standard Oil Co., was beginning to show its teeth, and it became necessary to spend more money on sites for depots in different parts of Mexico, "as a precautionary measure against negotiations with them falling through." They did fall through, as will presently be related, and Pearson started the sale of refined oils in Mexico in July, 1908. In the meantime the Minatitlan Refinery had got to work, but in the first months its yield was disappointing, and the Firm found itself obliged to buy a cargo of refined oils in the United States to keep its London agents supplied. In June there was a break in the clouds, and it was reported from the Northern Vera Cruz district that a large flowing well had been brought in in the San Diego field and was yielding 2,000 barrels a day. Two months later the famous "Dos Bocas" well in the same field also came in and hopes ran high. But unhappily, before the boiler fires could be extinguished, the gases ignited and set the well on fire. Heroic efforts were made to extinguish it but without success, and this promising well eventually burnt itself out. The fire lasted for eight weeks and at times the flames reached a height of 500 ft. It is estimated that a million tons of oil —worth £1,000,000—were destroyed, and in addition the Firm incurred heavy costs in compensating local landowners for damages to property.

This blow might well have been fatal to a less determined man than Pearson, and when presently it was followed by a fire which destroyed a great part of the Refinery, the fates seemed to be in league against him. But his faith in his properties was unshaken, and from the disaster at San Diego he drew the cheerful conclusion that if a million pounds' worth of oil could have been destroyed in one well there must be millions of pounds' worth more awaiting those who could get it. All the same, the immediate emergency was serious. The destruction of the San Diego well had thrown him back once more on the San Cristobal field, and that, too, proved disappointing. No new wells came in, and the original wells yielded less than had been expected. The selling and distributing agency had nevertheless to be supplied, and in 1909 Pearson found himself much more a buyer than a producer of oil. In June of that year the Firm purchased some 250,000 to 400,000 barrels of oil from Texas, and the Refinery input was reduced to 3,000 barrels daily. For the time being, and for a good many months to come, Pearson was to be a buyer rather than a producer of oil.

Some relief was promised from the Furbero field, the property belonging to the Oil Fields of Mexico Company, which had contracted to supply Pearson with oil, and he did everything possible to complete the pipe-line which was to connect it with Tuxpam on the Gulf of Mexico. But Tuxpam being an open roadstead presented a peculiarly difficult problem in the loading of the tankers. The usual practice of connecting lengths of pipe one at a time from a barge anchored in the sea, which is feasible in calm or moderately calm waters, was found impracticable in the rough sea of this coast. The pipe was often broken or badly bent, and much time was lost when the sea was too rough to enable the pipes to be connected. Mr. Body finally devised an ingenious plan by which the whole pipe-line was screwed together on a launching-way on the shore somewhat similar to that employed as a launching-way under the keel of a ship. Where there was sufficient land behind the sea-front to connect up the whole mile or more of pipe-line, the whole length was connected. Where the distance was insufficient, the lengths of the sea-line were split into two or three sections, and when everything was ready for launching, a ship or powerful tug was anchored near the site where the sea-line would terminate, and by means of heavy winches on the tug or ship the pipe-line was hauled from the launching-way into the sea, a new section being screwed in behind as the forward section was launched. Since the end of the pipe-line was closed, there was sufficient buoyancy even with the cast-iron stiffeners attached to each joint to enable it just to float, and when the whole length was launched, water was allowed to enter and sink it to the sea-bed.

The pipes having been thus laid, divers then went down and attached 120 feet of armoured flexible hose closed at the end by a blank flange to the seaward end of each of them. This, too, lay on the bottom when not in use, but its position was marked by a small buoy which was attached to it by a chain strong enough to lift it. Permanent mooring buoys were then provided for the tankers, which picked up the marking buoys with their derricks and raised the flexible hose and attached it to their own loading connexions. The oil was then pumped in by loading pumps located on the shore. This was an innovation in loading which many experts thought impracticable, but it succeeded perfectly from the start, and was afterwards used successfully by other companies in similar circumstances. As the necessity arose, further sets of pipe-lines and buoys were laid until there were four sets (or berths) of buoys each served by two submarine pipe-lines, giving a total loading capacity of 120,000 barrels a day.

But in spite of these efforts the Furbero field also proved a disappointment, and after two months the quantity it yielded fell below the minimum contract amount, and, though there were further drillings, never reached it with any regularity. The staff was doing splendid work, and Pearson never doubted that oil in large quantities was in sight, but he felt it necessary to apply the spur to all departments, and he now laid down a date when his properties must be self-supporting. He had bought his experience at the cost of eight years' anxiety and an expenditure, as he estimated, of £1,250,000 more than would have been necessary if he had known the business at the beginning, and it was rare good fortune, as he told his staff, that the properties were rich enough not only to cover this, but to bring the final reward. Still, they must push ahead, cut down costs and see that all departments were efficient and staffed with the right men. His letters from London and on board ship are a little sharper than usual in these months, but his staff understood their Chief and observed that, with all his warnings and exhortations, he was laying his plans confidently for a prosperous future.

In that he was well justified, but success came not from the Isthmus where he had first started and on which he had originally built his hopes, but from the regions two days' journey further north on which he had entered with some reluctance. In 1907 the crucial question had been raised whether to stay on the Isthmus, taking what the San Cristobal-Capoacan field gave and thereafter to stop, or to go north and to secure further leases and options along the coast-line between Vera Cruz and Tampico; and fortunately the decision was taken to go north. It was from the north that salvation came, and before the end of January, 1910, the Northern fields began to report the coming in of new and much more promising wells than had been found further south. At Tanhuijo—some thirty miles north of Tuxpam—a well yielding eighty barrels a day was struck at only 115 ft. below the surface, and early in February No. 1 was announced on the Potrero field with an abundant promise of more to follow, and several others followed in the San Pedro field. Sanguine and confident as he had been in the darkest moments, it was an immense relief to Pearson to see hope converted into fact after the years of anxiety and mounting expenditure, and from this time his word of command to his staff and partners was full steam ahead.

So far he had borne all the costs and risks of the enterprise, but the prospects now justified him in bringing the public in; and in May, 1910, the Aguila (Mexican Eagle) Oil Company, which had been formed in Mexico in the previous year with a capital of $30,000,000 (Mex.) to take over all the Firm's properties (with the exception of Minatitlan Refinery and certain lands on the Isthmus), made its first public issue of shares. Developments followed rapidly in the next few months. The pipe-line from Furbero to Tuxpam having been completed and brought into play, the Potrero field was joined up with Tuxpam by another line, and a third line, 100 miles long, laid down to bring oil from this field and all to the north of it to the port of Tampico, which became the headquarters of the Company.

On December 27, 1910, the famous Potrero No. 4 was struck and flowed uncontrolled with a production of 100,000 barrels a day for sixty days. Pearson was in Mexico City at the time, but on getting the news he hurried to the spot and remained there with his son Clive, controlling operations during the difficult and anxious business of capping this monster. The drillers had been taken by surprise, and though instructions had been given them to install a drilling valve, they had postponed this precaution in the absence of usual premonitory signs. But the driller had acted with great presence of mind when the gush came, and scrambling in the darkness through a thicket which was the only way left open to the boilers, had put out the oil burners,[1] and so averted a much worse catastrophe. There remained, however, the problem of closing down the tremendous flow, and for this a special appliance, afterwards known as the "Bell Nipple," was devised on the spot by one of the engineers, Mr. F. Laurie, who with his colleague, Mr. S. Weaver, finally overcame the difficulty of forcing it down against the great pressure of the spouting oil.[2] This success was only achieved by the courage and endurance of the engineers and their assistants, who had to work in an almost blinding deluge of asphaltic oil, which deafened by its roar and gave off suffocating gases that filled nostrils and inflamed the eyes and made work impossible for more than a few minutes at a time. It was an enormous relief to all concerned when on the sixtieth day the Bell Nipple was fixed and the wild well brought under control.

The greater part of the six million barrels which gushed out of this well in the sixty days ran to waste down the Buena Vista river and caught fire ten and fifteen miles down-stream. There was always a danger that one of these fires would travel up and back to the well, or that a fire would start in the immediate neighbourhood of the well. Fortunately, neither of these things happened, and a good deal of oil was intercepted by an earthen storage, which was filled to its capacity of three million barrels. This and other emergency work during the sixty days of the well flowing wild necessitated the temporary importation from the neighbouring hill villages of as many as a thousand men, who came into camp on five-to-six-day shifts, being replaced in the following week by relieving

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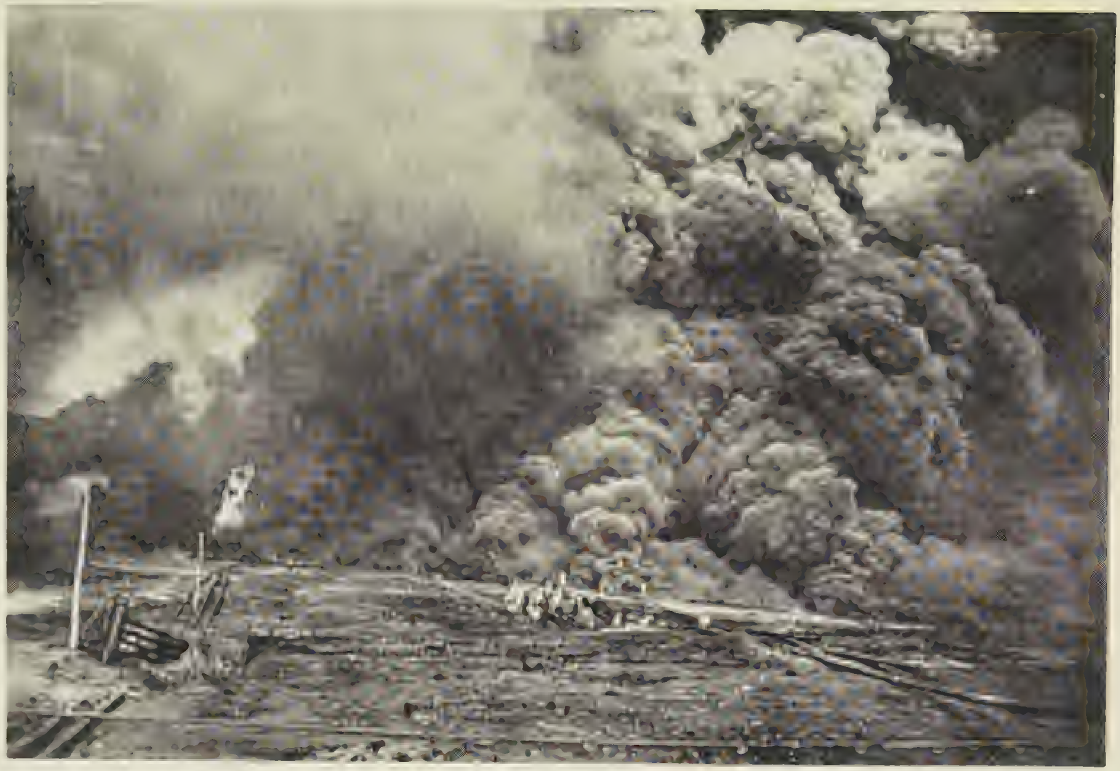
[1] This is the recognized danger-point in drilling for oil. If the oil is struck suddenly and gushes up while the fires of the boiler supplying the engine for the drilling machinery are still alight, ignition is very probable. For this reason the boilers are kept as far as possible from the derricks and engines.

[2] For a technical description of this apparatus, see an article on Potrero No. 4, by A. E. Chambers, member of the staff of S. Pearson & Son, *Journal of the Institute of Petroleum Technologists*, Vol. 9, No. 37, June, 1923.



FIRE AT POTRERO NO. 4, AUGUST 17, 1914

gangs from the same villages. During the same sixty days the pipe-line from Potrero to the coast, then under construction but not finished, was rushed to its completion. The effort was heroic, but all realized that this was one of the supreme moments of the whole enterprise.

From this time onwards, for the eight years till it was exhausted, this well yielded over a hundred million barrels, but not without one serious interruption. For on August 14, 1914, lightning set fire to the gas escaping from the well, and this gas fire melted the lead in the joints of the flow-line near the well-head, and next set the escaping oil on fire. From this beginning, the fire spread rapidly to the seepages, and in a short time the whole area was involved. Such a disaster could scarcely have come at a more unfortunate moment. The Great War had now broken out, and from a profitable speculation, oil had now become a national necessity. In addition, Mexico itself was in a highly disturbed condition, and the American Government had actually advised its nationals to leave the country. Practically all the skilled American workmen had accordingly gone from Potrero, leaving the fields in charge of a small number of British and other nationalties, who were quite unable to deal with the fire in its early stages, and before others could be got, it had assumed enormous proportions.

As soon as possible a large body of Mexicans was brought in, and batteries of sixty steam boilers were erected in a circle round the burning well, and steam pipes led as close as possible to the seepage fires, which, by means of earthbanks, water and steam, were all extinguished in the next few weeks. Then an earth-mound was built in a wide circle round the whole burning area and gradually pushed in until the fire was confined to a comparatively small crater, pipes being, in the meantime, pushed through the walls of this crater to enable the oil to be withdrawn before it could catch fire. At the end of twenty-four weeks the fire was so far under control that only the gas was burning, and this was eventually damped down by a blanket of clay on top of steel plates, into which pipes were inserted to draw off the gas. In the end the mound was covered with reinforced concrete to prevent the gas exuding, pipes being inserted into the concrete to carry it off to where it could be burnt at a safe distance. By the end of March, 1915, the fire was totally extinguished and the well restored to its normal yield.

This is to anticipate. From the beginning of 1911 onwards progress was uninterrupted, so far as the production of oil was concerned. New wells came in, pipe-lines were duplicated, a large office building and a Refinery were erected at Tampico and an office provided in Mexico City. But success in the oil business required a great deal more than the finding of oil. There were the questions of marketing and distribution, and the action of rivals and competitors in the same field. These will be dealt with in the following chapter.

CHAPTER XV

THE OIL WAR IN MEXICO

Pearson as Distributor of Oil—Opposition of the Waters Pierce Company—Playing for Time—A Draft Contract and its Failure—The Oil War in Mexico—The Potrero Success and its Consequences—A Bitter Campaign—Attacks upon Pearson—The Attitude of Standard Oil—Pearson's Victory—The Organization of Transport and Marketing.

When Pearson embarked on the oil business in Mexico, the Waters Pierce Oil Company, owned as to one-third by Mr. Henry Clay Pierce and as to two-thirds by the Standard Oil Co., had for thirty years enjoyed a monopoly of the retail oil trade in Mexico. The consumption of the country was seven hundred barrels of refined oil a day, and in the year 1908 the profits of this Company had amounted to £400,000, and in the previous three years had averaged £300,000. It charged a price, however, which the people of Mexico thought excessive, and which was not likely to be maintained if there were competitors in the field. It is scarcely surprising if in these circumstances they looked askance at the appearance on the scene of an Englishman of Pearson's known capacity and resources and unique position in Mexico. As a producer of oil in Mexico, he might even have been welcome, for they were not producers themselves and were actually in need of oil produced on the spot, which would not have to bear the freights and heavy duties that fell on the oil they were importing. But if he took upon himself to go into the distributing trade, it was only too clear to them that their position and profits would be very seriously threatened.

Pearson had resolved to be both a producer and a distributor of oil, and in the early years he relied even more on the distributing than on the producing side of his business to give him a return on his outlay. He was planning to set up a Refinery, and, if his own wells failed to give a sufficient quantity, he was in as good a position as the Waters Pierce Co. to import what might be needed. He, therefore, saw no reason why he should be headed off from trading in Mexico, but he was prepared for a fair deal with the Company in possession, and happening to meet Mr. Henry Clay Pierce in New York in the early months of 1903, he told him that he hoped to work in absolute accord with the Pierce Co.

Nothing further happened till August, 1905, and not much then. Mr. Pierce's son-in-law, Mr. Richards, being in Europe, asked for an appointment but changed his mind and departed for America without keeping it. In the following February he was in Mexico, and cabled from there that he was ready to " talk oil " and wished to know if anyone in Mexico was authorized. To this Pearson replied that he would wish to negotiate personally and that no one in Mexico was authorized. In June of the same year, Mr. Richards came to London and called upon Pearson, who now told him frankly that he had decided to build a refinery and go into the oil business. Mr. Richards replied that this new factor in the situation would have to be recognized, and expressed the hope that an arrangement would be arrived at. There the matter rested until April, 1907, when Pearson met Mr. Henry Clay Pierce in New York and spoke clearly of his intentions.

The position was one in which, as Pearson put it in a letter to Mr. Body, " we are both waiting for our trumps to turn up." At the moment Pearson had only his San Cristobal-Capoacan fields, which could not be expected to supply his Refinery for more than two or three years, and Mr. Pierce was still hoping to get more oil from Mexico independently of Pearson's operations. But Pearson had great expectations (which were justified in the sequel) of bringing in more and much more on his immensely extended options, and he considered that the money he had spent and the assets he had in hand or in sight would entitle him, in the event of amalgamation, to the lion's share of the capital. On the Pierce Co.'s side, as he argued, the main asset was a monopoly charging an exorbitant price which could easily be broken by a competitor, and was therefore not to be considered in any serious sense as goodwill, even though at the moment it was yielding a profit of £400,000 a year.

It was not to be supposed that Mr. Pierce or the Standard Oil Co., which at this time was behind him, would accept this view of the position without very cogent proof. Indeed, whatever his hopes might be, Pearson had still at that time to prove himself as an oil producer, and if his expected new wells did not come in, he would have been in no better position than the Pierce Co., which had to import most of their oil. Pearson importing oil to supply his Refinery would evidently be a very different kind of competitor from Pearson supplying that refinery from oil produced in Mexico. He himself recognized that if he were not producing more Mexican oil than was needed for the Pierce Co.'s refinery he might reasonably be asked as the new-comer to hold up his own refinery until further supplies came in. For the next few months both sides continued to play for time, and it was not till January of the following year (1908) that they came to close quarters. Then Pearson met Mr. Pierce in New York, and for three weeks they thrashed the matter out, with Judge Priest, representing the Standard Oil Co., holding a watching brief at some of their meetings. At the end of the three weeks, Pearson's patience was exhausted, and he announced that as no progress was being made he proposed to take his departure the next day. On this Mr. Pierce notified his acceptance in principle of the proposed draft contract by which Pearson was to have a third of the Pierce Co.'s profits for a period of two years on condition that he provided them with a stated quantity of refined or practically refined oil.

But it was one thing to agree in principle and quite another to get an agreed contract signed. The draft contract went backwards and forwards between Pearson, Pierce and Judge Priest, being amended and re-amended in transit until it was totally at variance with what Pearson had supposed himself to have agreed. At the end of six months he came to the conclusion that the Pierce Co. did not intend to settle on any terms that he could accept, and having advised Mr. Pierce that negotiations were at an end, telegraphed from London to his Mexico office to start preparations at once to enter into the retail business in competition with the Pierce Co.

Sundry attempts were made in subsequent months to reopen negotiations, but all proved abortive; and deeming war to be inevitable, Pearson prepared to wage it with all his might. His first step was to order from thirty to forty tank cars to retail oil in the chief centres, until his own installation was ready. Then he set about establishing depots at fifteen principal centres in different parts of the country, and set his agents to work to obtain contracts from the leading merchants. In the next few months the depots were increased to 160, and by the beginning of 1910 he was able to claim that his installation and selling organization were equal, if not superior, to those of his opponent, and that he was doing nearly half of the refined burning oil trade in Mexico, and nearly a quarter of the lubricating oil trade. The competition rapidly became a cut-throat one, and prices were cut to a third. Pearson expressed himself well satisfied that his losses had not exceeded £50,000 by March, 1910, but up to that date and for some weeks later his position was still an anxious one. The Pierce Co. knew that if he could not find more oil in Mexico than was yielded by the San Cristobal-Capoacan oilfields, he must in the long run be beaten, and confident as he might be of the capacity of the other fields, these had yet to be proved and the proving had so far been disappointingly slow. To get him committed to a retail trade beyond his power of supply and then to wear him down until he tired of importing oil and selling it at a heavy loss was their obvious strategy; and at the beginning it was by no means certain that they would not succeed.

The correspondence shows Pearson's anxieties on this subject during 1909 and the first weeks of 1910. He had relied on the Furbero field to supplement his two fields, and this was not producing and never did produce the anticipated quantity. His optimism was unquenchable, but for weeks he had to reckon with the plain fact that the oil in sight was not enough for his commitments and the strong probability that, like his opponents, he would have to go abroad for his oil and pay duty on it, as they did. Then in the nick of time the great Potrero de Llano field began to come in, and when a few months later the immensely productive No. 4 had been brought under control, the situation was saved. The reader who has followed the story of this difficult and dangerous operation in the previous chapter will understand with what anxiety it was watched by Pearson and his staff. After Potrero other fields came in, and before 1911 was far advanced, Pearson found himself in the position of being an immense producer of oil with every prospect of a large and lucrative export trade compared with which the Mexican distributing business would be only a side-issue and not a very important one.

In the meantime, the Aguila (Mexican Eagle) Co. had been successfully launched and was rapidly extending its operations. " Over 80 per cent. of our earnings," he writes in June, 1910, " will be obtained from the crude oil itself, and no competition of the Waters Pierce Co. can affect them. There is a market—a world-wide market, apart from Mexico —for crude oil of the quality we have brought in in the fields to the north of Tuxpam. I can understand Mr. Clay Pierce's pride being hurt by an interloper—as he deems us to be—coming and obtaining such a considerable percentage of the oil business. I say this because up to 1905 or 1906 the United States Government returns show that, in whatever state the Waters Pierce Co. were doing business, they handled from 100 per cent.—as was the case in Mexico —to a minimum of 85 per cent. When a man has been so successful in checking competition, it is very bitter for him to meet a strong competition having the most influential men in Mexico on the Board and backed by not only the sympathy of the nation but by the Government. Thus I can, to a certain extent, understand the personal bitterness he is putting into the fight. But, after all, what is the good of a man's cutting off his nose to spite his face, as he has been doing for some time ? "

This was no doubt the common-sense view of the position, but it took Mr. Pierce three years to recognize it, and for all that time he fought an aggressive campaign with increasing bitterness. Press attacks upon Pearson and the Aguila Co. appeared simultaneously in Mexican, American, French, and even in English newspapers, with the evident object of scaring possible investors or supporters of the Pearson Co. It was alleged that the Pearson enterprise was doomed to failure, that it was losing enormous sums, that its management was bungling and inefficient, that it had no real organization and no serious chance of securing native oil supplies. Pearson was said to have bribed and corrupted the Diaz Government, and when Diaz fell, in 1911, to have done the same to each of the revolutionary parties which were for the time being in favour. He was alleged to have got his holdings by questionable means, to have contrived so that obstacles should be thrown in the way of small-holders desiring to sell to others than himself and to have bribed members of the Government with shares in the Aguila Co. in order to obtain favours from the National Railway or to induce them to lend their names as directors. Rumours that he was broken and was going to sell out alternated with assertions that he was carrying everything with a high hand and a long purse. Denials were useless; as soon as one story was disposed of, another was invented, and those who invented them or published them seemed to care nothing whether they had the slightest foundation in fact. When the politics of Mexico became confused, Pearson was charged with using his position to influence the British Government and the British Minister in favour of one Mexican faction or another and of organizing the Banking interests of Europe to bring pressure on President Wilson and the Government of the United States. There was apparently nothing which his opponents were not prepared to allege in order to embroil him with the Mexicans and damage his standing and that of the Aguila Co. with the investing public in Europe.

In addition to these Press attacks, Pearson and his colleagues were shadowed by detectives, and his telegrams, or copies of them, were intercepted and read, though by what means he could never precisely ascertain. To know where and to whom he was selling oil, and whether he was buying it, and if so, in what quantities, were matters of high importance to his opponents, and their agents appeared to think all things lawful when war had been declared. A special effort was made at Washington to upset the arrangement with the United States Government by which Dr. C. W. Hayes, their head geologist, acted as geologist for the Pearson Firm and visited Mexico for two months each year. Dr. Hayes subsequently left the service of the United States Government, and joined the staff of the Mexican Eagle Oil Co., of which he became Vice-President.

Pearson never was in any doubt that peace was preferable to war, if it could be had on tolerable terms, but he was for long in doubt whom exactly he was fighting and with whom it would be worth while to negotiate. Was it only Mr. Pierce and the Waters Pierce Co., or was it also Standard Oil, which had a two-thirds interest in the Waters Pierce Co. ? In a letter (July 8, 1910) to the *Daily Mail*, which had published an emphatic denial from the Standard Oil Co. that the detectives who had shadowed him in New York were employed by them, Pearson plainly intimated his belief in at least the complicity of that Company. But in subsequent months he received information that the Pierce Co. and Standard Oil were " not on speaking terms " ; and for the next year it was extremely doubtful whether a settlement with the one would be a settlement with the other, or even be welcomed by the other in the obscure game which the two were playing between themselves. At all events Pearson's view was that nothing profitable could be done until these two had settled whether and, if so, on what terms their partnership was to continue. Standard Oil, meanwhile, seems to have had deeper and deeper misgivings about Pierce's obstinacy in continuing the fight when it had become evident that his opponent could not be worn down, and in 1912 its Chairman apologized to Pearson for the manner in which the Waters Pierce Co. had conducted its campaign, and asked him to believe that the Standard Co. dissociated themselves entirely from it. He accepted this overture and a little later the Standard Co.'s Directors formally buried the hatchet by giving him a Dinner in New York at which Mr. J. D. Archbold, Mr. A. C. Bedford, Mr. J. D. Rockefeller, junior, and Mr. W. C. Teagle were among the hosts.

Pearson was not the man to drive a competitor out of business if he could live on fair terms with him, but when Mr. Pierce continued his attacks after Standard Oil had made peace, he said with some heat that he would " smash the market so as to prevent his getting a cent of profit in Mexico." This was no idle threat, for by this time he was in a commanding position as an oil-producer, and the Mexican retail trade was a mere trifle in comparison with his great and growing world-business. In 1913 he estimated that Pierce could only hurt him to the extent of 5 per cent. of his profits, whereas he could hurt Pierce to the extent of practically the whole of his profits. By this time the Pierce Co. and Standard Oil had dissolved their partnership, the former having bought the shares of the latter, and Mr. Pierce was left in the field alone. But the end was now in sight, and in 1913 he agreed to an equal division of the trade in all refined oil products. The agreement was reluctant and the Press attacks continued for a year longer, when Pearson intimated firmly that, if they did not cease, he would take other strong measures.

In facing the rivalry of Standard Oil and the Waters Pierce Co., Pearson had from the beginning decided that the only basis on which he could be on safe ground and avoid being squeezed out in any one branch was to produce, refine, distribute and sell the finished article at retail prices. But this meant an immense and elaborate organization for transport and marketing after the production had been ensured. For these purposes two companies were formed in 1912 to work with the Aguila (Mexican Eagle) Co., one the Eagle Oil Transport Co., with a capital of £1,000,000, afterwards increased to £3,000,000, which provided for the ocean transport of the oil and at once ordered twenty tank steamers, including ten of 15,000 tons; and the other the Anglo-Mexican Petroleum Co., manned by members of the Firm, which with its staff of 800 working in its fine offices at Finsbury Circus House, handled the marketing of the products in all countries except Mexico, for which there was a separate organization. The directors of this were the Hon. Clive Pearson (Chairman) and Messrs. R. P. Brousson, H. J. Carr, J. H. Macdonald, H. W. Masters, E. H. Mundy, and J. Purdy. Later it absorbed the selling organization established by Sir Thomas Bowring already referred to, and worked unceasingly at creating and supplying a world demand for the products of the Mexican fields. Important contracts were entered into with the British Admiralty, and with railways and other enterprises, for the supply of crude, fuel and refined oils; and depots, bunkering stations and agencies were established in all parts of the world.

There was now an abundance of oil, so much, in fact, that rivals became customers, and in March, 1912, the Aguila Co. entered into a contract with the Standard Oil Co. for the supply of ten million barrels of crude oil. Development continued steadily all through the years of the war. The Eagle Co.'s property extended over an area of 1,600,000 acres; they owned freehold property in the cities of Mexico and Tampico and throughout Mexico for tankage and installation purposes; they had 175 miles of pipe-lines between the oil-fields and the seaports, 120 miles being double track, and steel tankage with a capacity of 7,000,000 barrels. The two refineries together were capable of refining 65,000 barrels a day, but even this was greatly below the capacity of the oil-fields, which were capable of producing 200,000 barrels a day.

The whole was now an enormous and very profitable business, with immense properties and a far-reaching organization. In building it up Pearson had gone far beyond the limit that he originally fixed for himself, and embarked £5,000,000 of his own and the Firm's capital instead of the £1,500,000 which he had been prepared to lay down at the beginning. But he always denied that he had ever "gambled in oil." At each step, as he claimed, he saw daylight, and never moved without seeing it. And, in fact, the records show that, if he was, as he confessed, an amateur on the management side of this business, he had from the beginning grasped its guiding principles with a remarkable insight. What in the end carried him through was his initial grasp of the fact that in order to ensure success his operations would have to be spread over the widest amount of territory and take the largest number of chances. The original oil-pools which led him into the venture proved in the end to be a very small part of the enterprise, but the million and a half acres stretching along the North Vera Cruz coast yielded abundantly. There was trouble still to come, as will be related presently, but by the end of 1912 he had not only found his oil but built up a world-wide organization for its distribution and marketing.

CHAPTER XVI

HOPES AND FEARS

Pearson's Letters from Mexico—Doubts and Fears—Causes for Satisfaction—Life in Mexico City—Doing up the House—Friends in Mexico—" What Fools we Mortals be "—Hardships in the Oil-fields—Purchasing Cowdray—And Dunecht.

THE narrative has now been carried to the point when the great oil adventure had come to its triumphant conclusion, and a pause may fitly be made here to show Pearson's personal part in it a little more intimately. Very few of his letters have survived, but there is fortunately a batch written to his wife in the years 1908 and 1909, when he was in Mexico without her, which show his thoughts and moods at this most critical time.

As I have already said, he maintained to the end of his life that he never gambled in oil or anything else, and at the worst of times he seems to have kept steadily in view a certain point beyond which he was resolved not to go, and from which he could have retreated with a substantial residue of his wealth intact. But though the loss would have been immense, even more galling to a man of his temperament was the thought of defeat and the crushing blow which it must have inflicted on the position and prestige which he had won by twenty years of daring and successful enterprise in Mexico and all parts of the world. Outwardly he kept a bold front, but to his wife he confesses that he has black moods of fear and doubt.

In February, 1908, he stopped on his way out to Mexico at Tulsa, Oklahoma, then the centre of the most prosperous and best developed oil-fields in the United States. Hopes and misgivings mingle in his account of what he saw :

February 8, 1908.

On Sunday we left by the 7 train for the oil-fields —an hour's run, bitterly cold—and were shown round

PEARSON'S HOUSE IN MEXICO CITY

> them. The grandest sight imaginable, beautiful country, 2,000 rigs, 700 big tanks, and a tract of country twice the size of Paddockhurst and Balcombe of productive wells of magnificent oil. I marvelled, and was both encouraged and frightened at the sight. The Standard Oil are buying up the oil and storing it in tanks. It will not cost them delivered on the East coast at their Refineries above 30s. a ton, and the quality is such that if they were prepared to work without profit, they could sell cheaper than I could in the European markets when delivering at cost price. This was the frightening aspect. But as they do not work for nothing—nor is this low price likely to continue—I finally feel that they cannot undersell us without harming themselves as much as they would us. At first I feared they might be able to kill us without incurring a loss themselves.
>
> I was encouraged by the fact that if we find such a pool of oil in Mexico on our lands—and I feel we shall—that it will be wholly ours instead of belonging to 8 or 10,000 people as the pool does here.

" Tulsa, a delightful town, now 35,000 people, four years ago only an Indian trading village, brings home to me," he says finally, " more vividly than any imagination can, the immensity of the enterprise we are engaged upon. But with all its brilliant prospects, it may be there is a long road to travel before they are realized."

No other letters have survived from the year 1908, but the tale is taken up and followed consecutively in the year 1909. In February he is in New York engaged in " a prolonged and strenuous settlement with the American Hawaiian Steamship Co. about the sailings in connexion with the Tehuantepec Railway," and endless pow-wows, which came to nothing, with Mr. Clay Pierce over the oil battle in Mexico. There comes a sanguine telegram from the Tabasco oil-field about high-quality oil having been found " it is hoped in paying quantities " (a hope not realized), but he confesses himself " tired and cold," and says despondently that he is " not the man he used to be," but a "poor companion fit only for struggles and work."

Ten days later he is in Mexico City, cheerful and gloomy at the same time, arguing with his doubts and fears but scarcely concealing them :

> February 14, 1909.
>
> There is—at all events for me—no royal road to fortune, so long as we are ever setting goals for us to realize ahead of the last ones. The happy future I depict is rather elusive, being for ever swept ahead.
>
> Now I am here, I feel much more content with the position of affairs than when I am away. That is, I feel happier about the oil—as I can control it—but less happy about finance, as I am away from it. But finance is only a question of selling things at too cheap a price, if pressing, so I ought not to worry about the normal conditions of business. But I have to admit that the oil has worried me (and rightly so) a lot. But once more I can repeat that I feel, nay I know, we shall come out of it all right, if I only will keep my ambition in regard to it within bounds and see that the money required for patient development is found without interfering with my other demands (including Cowdray).

> February 24, 1909.
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> Ash Wednesday, forty days of Lent.—I am feeling, mine own, as I am sure you are, that our Lent is not confined to forty days a year. If it were, we should be joyous children instead of overburdened souls striving after big things but nervous with the responsibility of them.
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> I have been reading some of Sir Walter Scott's novels for the last month, and I cannot help but think what a craven adventurer I am compared to the men of old. I am slothful, and horribly afraid of two things—first, that my pride in my judgment and administration should be scattered to the winds, and secondly, that I should have to begin life again. These

> fears make me a coward at times. I know that if my oil venture had to fizzle out entirely that there is enough left for us to live quietly at Cowdray. Yet until our oil venture is a proved success I continue nervous and sometimes despondent. I cannot excuse myself for having such fears, moods and tenses. They are unworthy of my wife's husband and of my past career, and show I am unequal to the present load, having due regard to carrying it with comfort and faith.
>
> I think the real proper sense of responsibility would be to be *anxiously on the look-out but without fear.* This is what I try to be, but alas! the buoyant hope or the exaggerated fear will, at times, intrude.
>
> Such are my fancy pictures during my restless nights—the many possibilities between the cup and the lip.

His spirits rise after a week-end at Vera Cruz, which he finds "vastly improved." "The clean asphalt streets and done-up houses make it difficult to realize that five years ago it was a filthy abomination. The electric cars add greatly to the beauty and attractiveness of the city. Everything doing well. The new power-house is a treat." Now (March 6, 1909) he proceeds to enumerate the "causes of satisfaction." Vera Cruz is "satisfaction No. 1"; the Orizaba Jute Mill, in which he was co-operating with his brother-in-law, Mr. Kinnell, was making flour-bags (a profitable new line), and promised to pay a 10 per cent. dividend (satisfaction No. 2); the Tehuantepec Railway was doing well (satisfaction No. 3); the Cattle Company under his son Harold's supervision was prospering (satisfaction No. 4); Puebla Electric Power and Trams was going right (satisfaction No. 5), and so:

> There is only left the oil. I should not express it as an "only" as it equals in the amount at stake all the other interests. But it will gradually disentangle itself. It means time. The prospects of finding extensions of the San Cristobal field are good. Three geological reports—each confirming the other—are very encouraging, and the moment a big field is proven

> all anxiety as to the eventual success of the refinery will disappear and we shall be able to assume that my strenuous days are approaching an end, and that (always D.V.) we shall realize a fine living income (even sufficient for occasional extravagances) for this great venture. I fear this extension of the field cannot be proven for some three to six months, but I am hopeful it will be found to be all right.

One would have thought it was enough, but he throws in quite casually that he is thinking of embarking on a new cement business in Mexico and sees great possibilities in it.

His burdens were increased by a severe attack of influenza which kept him to his bed for ten days, and left headaches and neuralgia for three weeks afterwards. But he has friends with him, especially his friend Dr. Mackew, who prescribes exercise as the best way of getting well. "Each night the Dr. and I walk to the Restaurant at Chapultepec—say 2½ miles—have two or three ham sandwiches (really good) and a bottle and a half of German beer each, rest to smoke and talk for a quarter of an hour; then walk back, take a bath, into bed, milk and bread, the evening paper and sleep until morning. An excellent cure, and I am feeling quite fit again."

For those who had sound hearts there were compensations for living in Mexico City with its beautiful gardens, glorious views of distant mountains and the exhilarating atmosphere, and cool nights at its 7,000 ft. level, though he has to record that one at least of his guests had to retreat hastily to a lower altitude. And then ranking high among his "satisfactions" was the fact that his son Harold had come, bringing his wife with him, to "share the burdens of the oil-fields." Mr. and Mrs. Harold Pearson take car to Tampico, go up the river by boat for four or five days, then strike across country on horseback, sleeping in mud houses on the way, and finally reach the oil-camps. Pearson has some apprehensions about this journey, especially for his daughter-in-law, and is greatly relieved to be able to report that "H. and B. were delighted with their trip." "The sun, the insects, the bad food, the rough sleeping have no terrors for them, whilst the eight or nine hours in the saddle and the glorious country have every attraction. On the last part of their trip in a private house they slept thirteen in a bedroom." In another letter he adds, "H. has been most useful—full of work and common sense. I am most thankful for his having (as he really has) taken the burden of the oil-fields off my shoulders."

While his son and daughter-in-law are away, Pearson prepares a surprise for them by doing up the house in their absence, the spacious house in the Spanish style, with its double patio and galleries within—2a, Puerte de Alvarado 53, formerly the British Legation—which was for many years his home and his wife's in Mexico City. One of his friends said of him that he never could look at anything without wanting to do something to it, and now he reports himself grouping rooms into suites, shifting the furniture, putting in bathrooms, choosing "light green wall-papers and carpets and linen curtains with green decoration." He finds at the end that all the furniture has gone out of his wife's room, and has to confess the crime and beg her to buy a new set of furniture and send it out. In the meantime, he is entertaining his friends at dinner and lunch, and sends news of a polo match "in which Harold's team won."

By mid-April he is on his Tehuantepec train, inspecting the railway and visiting the oil-fields. He has guests with him, Americans from the Legation and others, finds them good company and reports that "though the thermometer is 102° in the car, no one complains." At Minatitlan, where the great refinery is about to start, he is "sweltering in heat but otherwise happy." "Hopes in the oil-fields are high" (as they always were), "but I should like," he adds, "to be realizing our hopes." But one encouragement seemed to be a little more than hope. "The chief geologist to the U.S. Government (Dr. Hayes) has spent some six or seven days on some of our oil-fields, and I was intensely glad to learn from him that he considers our fields are most promising. When I heard his opinion, which is one to be valued, I nearly cried. But as I cannot shout until I am quite out of the wood, I had to refrain from shouting. Yet the hurrah will be uttered, I am sure, this year." The "hurrah" was not uttered that year, nor till near the end of the following year, when the great Potrero wells brought all home.

During these weeks the Clay Pierce struggle was going on, and as always when intricate business is on foot, he confides every detail to his wife. " I say to Clay Pierce, ' consider your goodwill as being equal in value to my prospects and contracts.' They are infinitely more valuable, but as there is no method I know of by which they could be valued, I suggested the broad base which is strongly in his favour. He says ' my goodwill is a tangible asset, your prospects are prospects only '—an absurd proposition." Clay Pierce all this time was banking on Pearson not finding oil, or not finding it in paying quality and quantity—which, as the reader may infer, was not quite so absurd a hypothesis as Pearson liked to think it. Two years later Pearson had cause to be thankful that his opponent had not accepted any of the proposals made to him at this time, but though he never seems to have hesitated to cut his selling price when the Pierce Company cut theirs, there were moments when he reflected gloomily on the cost and folly of this conflict. " What fools we mortals be, for in the fight the goose that lays the golden egg is gradually being killed." " We are not losing money " (this was perhaps a little too sanguine), " but we want to make it."

Finally all through this Mexican visit he was laying the foundations of the Aguila (Mexican Eagle) Company which at the proper time was to take over the oil business. He saw it in his mind's eye as largely a Mexican Company, manned by Mexicans, with a large number of Mexican shareholders, who would take an active interest in its operations, and be on guard for it in the vicissitudes of Mexican affairs. It was, as the event proved, a wise and far-sighted idea, but there were many obstacles to its realization. In these days when hopes were not yet facts, Mexicans were slow to share his sanguine views ; most of them knew nothing about oil, and some were partisans of the long-established Clay Pierce interest, which was naturally concerned to prove that Pearson could not and never would succeed. For these and other reasons, he has rather ruefully to admit that progress has been slow.

The record of this visit happens to be full of detail, but all were more or less of the same pattern—periods of intense activity divided between great engineering works, railway and harbour construction, drainage schemes, electric tram and power schemes, and finally the great oil adventure, surpassing and at some moments threatening to eclipse all. From 1900 to 1912, he spent on the average three months of each year in Mexico (generally between December and May), and in 1910 and 1911, the years that were the climax of the oil adventure, he was out from September, 1910, to May, 1911, and back again from July, 1911, till November of the same year. Generally his wife was with him and her sister, Mrs. Kinnell, whose husband had started the jute mills at Orizaba, with which the Pearson interests were associated from the beginning. In the later years, his younger son Clive came out, and, as already recorded, was with his father in Mexico City when the first great Potrero well went wild. Together they went at once to the spot, joined with the workers in the effort to cap the well, and took their share of the risks of fire and suffocation and the very real hardships of the camp. Lady Cowdray recalls the strict injunctions that she received, when in Mexico City, to send no luxuries or special provisions for their comfort which could not be shared by the whole camp. Her husband was always firm on the point of not asking any of his partners or employees to do what he was not prepared to do himself. In Mexico prospecting for oil involved hardships and risks which the wealthiest of prospectors could not avoid, if he was to do his own business with any thoroughness, but Pearson had the equable kind of constitution which enabled him to pass from the 7,000 ft. level of the Mexican plateau to the sweltering heat of the lowlands without suffering in health, and he was only with great difficulty persuaded to take seriously the risk of malaria and yellow fever that attended some of his journeys.

Though work was hard and incessant, life in Mexico was gay and cheerful, especially when Lady Pearson and the young people were there. The Pearsons entertained lavishly at dinner and lunch ; there were dances, riding parties, polo matches, picnics to the works by the Canal, or to the lovely hanging gardens by the Lake of Xochimilco, visits to villas in the beautiful suburbs of Tlalpam and Tacubaya, and above all, in the early years, week-ends at Mrs. Kinnell's house at Orizaba. That was situated in a charming valley about half-way down between the plateau and Vera Cruz, but still 4,000 feet above the sea and commanding views of the great snow-capped volcanoes. Oranges and scented orchids grew in its garden and cascades of maiden-hair fern ran down the mountain-sides. Mexican friends were many and intimate: President Diaz and his wife first and foremost, and after him Señor José Limantour, the Finance Minister; Señor Romero Rubio, War Minister and father of Madame Diaz; Señor Mariscal, former Minister at St. James's; Señor Sebastian Camacho and Señor Pedro Rincon Gallardo, former Mexican Minister in St. Petersburg, whom Pearson had known in London and who had come to New York in 1889 to plead with him to undertake the Canal; Señor Guillermo de Landa, first President of the Mexican Eagle Company and Governor of the Federal District of Mexico; Señor Leandro Fernandez, Minister of Communications; General Francisco Z. Mena, another Minister of Communications; Señor Teodoro Dehesa, Governor of the State of Vera Cruz; Señor Roberto Nunez, Sub-Secretary of the Treasury; General Gonzalez Cosio, Minister of Communications; Señor Pablo Martinez del Rio and Señor S. M. Cancino. The list might be greatly extended but a special word must be said about the Firm's legal advisers. In the earlier years Señor Lic. Genaro Raigosa and Señor Lic. Emilio Velasco cautiously and successfully guided Cowdray's unaccustomed steps through the labyrinth of Mexican law and practice. Whilst the most minute care was always applied by Cowdray himself to the wording and implications of his many contracts, he was naturally dependent in legal matters on expert guidance. And to no one should greater credit be given for sound advice and legal help than to Señor Lic. Luis Riba of the firm of Cancino & Riba, a leading firm of lawyers in Mexico City. For over 25 years and continuing to this day Mr. Luis Riba has with the greatest loyalty and with the soundest advice contributed to the successful ventures of S. Pearson & Son, Ltd. His portrait, as that of a valued friend, adorns the walls of 47, Parliament Street.

THE PEAK OF ORIZABA

By permission of Ernst Wasmuth, Berlin

When the revolution came and Diaz fell, many whom the Pearsons had known well were driven into exile and made their homes in Paris, where Madame Diaz and the Limantours are still living. Old Mexican friends were frequent visitors to Dunecht in after days and greatly enjoyed the sport which their host provided for them.

Such in these years was Pearson's life during the three months that on the average he spent in Mexico. But Mexico was only one part of his life. A glance at the list of his contracts (Appendix I) will show the burden of responsibility and liability that he was carrying elsewhere. The great Dover Harbour contract, the Malta Dry-dock and Breakwater, the East River Tunnels in New York, the Pará Port works, the Pekin Syndicate's railway, the Hull Joint Dock—to mention but a few of the Firm's undertakings—were all in his hands in these years, and upon their success he depended both to finance the great adventure in Mexico, and for final insurance against too heavy losses if that should fail. His belief in his star is what most strikes one in reading the records :

> Friday, September 24, 1908.
> 16, Carlton House Terrace.
>
> *Cowdray.* I settled the terms of purchase yesterday. Price £340,000. It is a big venture, but even if the oil does not prosper and we do not become more heavily involved than our present commitment (which is of course very difficult to avoid), we cannot, I think, be accused of undue rashness in buying the property."

Two years earlier he had taken a three years' lease, with option to purchase at the end, of the great property of Dunecht in Aberdeenshire, with its 9,000 acres of farmland, moor and forest, and at the end of the three years he completed the purchase and presented it to his wife. With all that he had upon him in these years and the anxieties that he confesses, a man of different temperament might have hesitated before giving these hostages to fortune, but this was never his way. Wealth came to him by making and not by hoarding; no thought of possible disaster or liabilities which might have to be met if his hopes belied him, ever seems to have prevented him from spending and giving with the utmost profusion while the money came in. He despised the rich men who live as if they were poor and walk in dread of what the future may bring. The possession of Cowdray, the thought of what could be done with it, the dream of building a new castle to equal the old one whose splendid ruin stands in the park, were incentives to him. He speaks of the future export trade in Mexican oil as "the trade that I am—in my dreams—hoping will build the new Cowdray Castle and furnish it with one year's earnings." At the darkest moment in Mexico, he is still certain that "in three or four years we shall be justified in beginning to build the new castle." He had, as it turned out, other plans for Cowdray, but within the four years he had the means of building many castles had he chosen.

Splendid as his achievement was when the great oil-wells came in, there was to be little peace for Pearson and his colleagues of the Mexican Eagle Company. No sooner had the question of getting oil been solved than fresh difficulties set in and the struggle took on a new and sometimes more dangerous form. The story of this must be reserved for another chapter, but in the meantime it may be recorded that in July, 1910, Pearson was raised to the peerage under the title of Baron Cowdray of Midhurst, by which name he must in future be called.

CHAPTER XVII

REVOLUTION IN MEXICO

A Letter to Lady Denman—The Fall of Diaz—Cowdray's Regard for Diaz—Revolutionary Troubles—Difficulties of Foreigners—A Serious Emergency—Dr. Hayes's Reports—Help from Admiral Cradock and Captain Doughty—Carranza's Decree—British and American Remonstrances—Persistence and Courage of the Oil-workers—Pearson Parts with his Control—Attitude of British Government—Negotiations with the Royal Dutch.

Nothing in these years gave Cowdray greater pleasure than the good news which came from Australia of his daughter, "Trudie," and his son in-law, Lord Denman, who, in 1911, had been appointed Governor-General of the Australian Commonwealth. Lord and Lady Denman had all the qualities that Australians like in their Governors. They were fine riders and knew all about horses; they loved and practised all sorts of outdoor sports, and, when ceremony was not required, were always friendly and forthcoming. Cowdray and his wife corresponded regularly with their daughter, and sent her out from England furniture, silver, or anything else she might need to help her play hostess at Government House. One of his letters written at sea on his way out to Mexico in the spring of 1912 reveals his thoughts on affairs generally, and the oil business in particular at this moment:

> For weeks I have been wishful to say two things: (*a*) how gratified and pleased we are to hear on every side from Liberals and Conservatives alike that Denman is doing his work most successfully and that you are doing your part of it with brilliancy.
>
> Such universal commendation is dangerous. It might in others, but not in ours, beget conceit and

slackness. Harcourt mentioned when dining out that his selection is more than justifying his choice.

I fancy the Government will get through this session all right. But an Irish Home Rule Bill will need great skill to get over the many bogs and pitfalls *en route.*

I express this opinion, as there are some of our own party who are thinking otherwise. I believe the Government's life is more dependent on the way in which it handles the coal strike than upon this session's legislation.

When this is settled and if it be settled to the general content of the country, the Government will be entitled to great credit. But it may come a cropper over it with the greatest of ease. The position is most difficult. The miners control the destinies of the nation. Trade is good, but they are united and can (and will, I believe, if they are not placated) bring the whole of the industrial life to a stoppage for several weeks. Maybe two or three months. Passions are running pretty high. Some of the Districts—both sides—are wanting a fight. Personally, I would prevent, if that were possible, and it might be possible, any union or combination of unions having such a power. The strike cannot be allowed to take place, the results would be too disastrous—and the fate (not immediate) of the Government is far more tied up in this business than it is by its own legislative efforts.

(*b*) The other thing is oil in Mexico. Generally speaking, the oil is flourishing. We are not out of our troubles, but are expecting to be soon, say in twelve months hence. The fields are developing slowly, but if we have good luck, before June next we should have added say two more proved districts to those we have, and if by the end of the year we could add two more I should be content.

We have formed a S.S. Company to handle the oil, and shall have in about $2\frac{1}{4}$ years some 20 tankers (half 15,000-ton boats and half 9,500-ton). We are friendly

> with the S. Oil, and with our ships we can get good prices for the oil delivered. The market is very favourable to the Aguila shares.
>
> These isolated risings are doing the country harm, frightening visitors and making Mexican things unpopular. If the position of the Aguila Company were doubtful, the present position of Mexico would add greatly to the difficulty of finding money required for development. But fortunately we are fairly independent of the internal conditions of the country, and thus we need not be much worried about them. Still we should like them to quieten down, as until they do we are always liable to have trouble in our fields."

After outlining certain family plans which may be realized if his " dreams " come true—" dreams," meanwhile, " to be kept locked in the family cupboard "—he adds a postscript :

> P.S. I have been wondering what your impression will be of my letter. Whether you will think I am allowing myself to be a visionary, whether I have become unduly optimistic, or whether (which is the fact) my views are those I put in front of me and try to realize. Dame Fortune is very elusive ; the only way to succeed with her is to sketch a fortune which you think you can realize and then go for it bald-headed. The headaches, the fears, the ceaseless work (work which starts each morning as if nature had not been exhausted the night before but existed in inexhaustible generosity), the endless disappointments that will be met not only each day but many times a day, the sacrifices (thousands of them) that have to be made, all become incidents that have to be overcome and forgotten. Then Dame Fortune wooed in such a manner usually succumbs.
>
> You now know my goal, and if I realize it you know what the result will be. If I fail—well, we shall be where we are and I shall have the satisfaction of knowing I fought a big fight, one worthy of a fighter, and

> that it is no disgrace to have lost, however keenly I may feel the disappointment at the time.
>
> I am still sane and sound, but I have fixed the goal I hope, with God's help, I may reach in three years or so.

The mingled hopes and fears with which Cowdray entered upon the year 1912 may be gleaned from this letter, but it is necessary to go back a little to explain what was happening in Mexico.

On May 15, 1911, Porfirio Diaz resigned the Presidency of the Mexican Republic and on the following day left Mexico for ever. He had been re-elected for a seventh term as recently as September in the previous year, but for the first time in his long and brilliant career his authority was seriously challenged. Three years of crop failures and trade depression had produced a simmering discontent, on which his rivals and opponents were quick to play with allegations that his hand had lost its cunning and that his rule had become a tyranny which threatened the national independence. The old drift to faction and anarchy now began to set in, and his principal opponent, Francisco Madero, passed from political agitation to armed rebellion. Diaz had Madero arrested, but he escaped from prison, issued a manifesto to the country, and by December, 1910, had a dozen States in arms against the President, who, finding himself unable to resist them, bowed to the inevitable and quitted the country. A fortnight later, Madero entered Mexico City in triumph.

It was said at the time that the old President owed his downfall (and Mexico its subsequent political troubles) to a toothache. He had been suffering from toothache at the beginning of May, 1911, when Madero started his revolutionary movement, and sent for a dentist to have the tooth extracted. Unfortunately something went wrong and the extraction set up septic poisoning of the jaw, which caused him excruciating pain and threw him out of action at the moment when his own strong hand was most needed to direct the Government forces against the revolutionaries. It is, indeed, quite probable that if he had been himself, he would never have permitted the Madero movement to gather strength until he was unable to resist it. Some interesting details of this time are supplied by Mr. Body, who was then living at Vera Cruz:

> Towards the middle of the month of May, 1911, it was clear that the revolutionary movement had succeeded, and the President decided to resign. Government troops were posted in the streets surrounding his private residence to prevent any demonstrations, and only his family, intimate friends and ex-Ministers were allowed to approach.
>
> One evening Señor Dehesa, the Governor of the State of Vera Cruz and an intimate friend of the General, came to see me and stated that he was confiding to me a very secret matter in connexion with the ex-President, and that outside the ex-President and his family and himself (Señor Dehesa) no other person at that time was aware of what he was going to tell me. The secret was that General Diaz and his family, including his son Porfirio and his family, were that night leaving the City for Vera Cruz by a special train, and I was asked if I would put my house at Vera Cruz at their disposal until the steamer left to carry them to Europe. I was also asked if I would arrange for Mr. Fred Adams to proceed to Vera Cruz on the ordinary night train to advise the military commander at that Fort that General Diaz and his family would be shortly arriving. The only other person allowed into the secret then was Mr. E. N. Brown (American), the President of the National Railways, who arranged for the special train.
>
> It was considered a signal honour that two out of the four chosen for this special service should be Englishmen—Mr. Fred Adams and myself—but the British Colony in Mexico was held in high esteem by the Mexicans, and it may fairly be claimed that this was in great measure due to the high character of the many English people who were connected with the Pearson enterprises.
>
> The special train conveying General Diaz and his

> party left Mexico City just after midnight—the President's son and his family having only a few hours' notice that they were to go that night. During the journey to the coast the train was attacked by some rebel bands. It was stopped, and the escort and some members of the party chased them off. These bandits were unaware whom the train was carrying. The party arrived safely at Vera Cruz and remained there for some days before embarking for Europe.
>
> During the period of General Diaz' administration the City of Vera Cruz had been antagonistic to him on account of the severe measures he took in the early years of his Presidency against members of some of the prominent families of the City who, it was alleged, were plotting his overthrow, and many feared that his stay in the Port City would be courting danger ; on the contrary, however, now that he was almost a fugitive, sympathy turned in his favour, and he had a marvellous reception when it was known that he had arrived amongst them, and the scenes on the day of his embarkation were often pathetic in their display of devotion.

The fall of Diaz was a heavy blow to Cowdray. He had an unbounded admiration and affection for the old President, and for the twenty-four years since he first came to Mexico, had worked with him in the most perfect accord. Together they had solved the great drainage problem of the Mexican plateau, built the Vera Cruz Harbour, made a great and prosperous enterprise of the Tehuantepec Railway, developed the railway system of the country, provided trams, electric light and power, and other essentials of a modern community. From his adventurous and romantic beginnings as a leader of revolt against the Emperor Maximilian, Diaz had become the economic saviour of his country, and in Pearson he had found exactly the man he needed, the man who would perform what he undertook, who never wanted to amend his contracts, who could be relied upon to deliver the finished work at or before the date agreed upon. The relations of the two men were much more than those of Head

PRESIDENT PORFIRIO DIAZ

of Government and Government employee or contractor; they were almost, as Pearson used to say, those of father and son; and notwithstanding that neither could speak the language of the other and all talk between them had to be through an interpreter,[1] they seemed to understand each other instinctively. Whether in finance or public works, Pearson in dealing with Diaz had none of the difficulties which in those days were supposed to attend dealings with Latin Republics, and in all the records of their transactions, none can be found which throw the slightest shadow of sharp dealing or overreaching on the one side or the other. Diaz applied a firm discipline to the factions which before his time and afterwards made anarchy in Mexico, and his enemies alleged that as he grew old he lost his grip and became arbitrary and overbearing, but to the last he was honest and incorruptible and most sincerely devoted to the good of his country. Cowdray had the deepest sympathy with him and offered to place Paddockhurst at his disposal as a residence in exile. He preferred, however, to live in Paris.

With the departure of Diaz, Cowdray found himself in a sea of political troubles, which threatened all his interests in Mexico, and most of all his oil interests. As the friend of Diaz and his partner in the economic development of the country, he was not likely to be in favour with the newcomers, and there was the further difficulty that none of them for the next few years had any firm grip of the country, or were in a position to defend the property of foreigners if this was attacked by a rival faction. Cowdray desired only to remain neutral and to behave with absolute correctness to any Government which was accepted by the Mexican people, but all the Governments proved to be transient and embarrassed phantoms fighting desperately for their lives with revolutionaries who found it profitable to make trouble by attacking the foreigners and endeavouring to hold them to ransom. The foreigner, and especially if he were an Englishman, was in a peculiarly difficult position. He might call upon his Government to protect him, but, if he did so, he ran the risk of raising the Mexican people against him; and his own Government, moreover, had always to consider the delicate question of the Monroe doctrine and the interpretation which might be put upon it at Washington. With an American President anxious to stand out of Mexico, and powerful interests in the United States unwilling that Great Britain should assume police duties in that country, the Englishman who looked to either to protect him was very likely to fall between two stools. We may see all these difficulties and perplexities reflected in the story of the next few years, and if the Pearson properties escaped without serious damage, it was mainly due to a skilful and patient diplomacy at headquarters and the skill and courage with which the men on the spot dealt one after another with the emergencies that confronted them.

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[1] The interpreter was Mr. Body, who had great fluency in Spanish and by his tact and courtesy established the friendliest relations with the President and indeed with all Mexicans.

As a clue to what follows it may be well at this point to summarise briefly the course of events between the fall of Diaz and the end of the Great War.

Madero's reign was short and troubled. From the moment of his inauguration he was fighting with insurgents, and all through 1912 the conditions were chaotic and many foreigners were killed in the conflicts between the factions. In February, 1913, Madero was seized and killed by General Huerta, who succeeded him as President and persisted in the teeth of President Wilson's refusal to "recognize" him. But he in his turn was challenged by Carranza, and after a conflict with the American Government in which the latter occupied Vera Cruz, was forced to resign in 1914. Carranza was next opposed by Villa, who, in 1915, drove him out of Mexico City, but was himself defeated by Obregon. A Conference of Argentina, Brazil, Chile and other Powers then tried to restore order and recognized Carranza as *de facto* President. Villa refused to yield, and his adherents took the aggressive against Americans, assassinating eighteen on Mexican soil and seventeen more in a daring raid on Columbus, New Mexico. An American punitive expedition, under General Pershing, was thereupon sent into Mexico, but it failed to capture Villa, and since its presence was resented by all the factions, and so small a force could do little to restore order, it was withdrawn in February, 1917.

By this time the United States was coming into the Great War, and the situation was further complicated by German efforts to stir up animosity, and the fantastic attempt, revealed in the famous Zimmermann Note, to persuade Mexico and Japan to join each other in an attack on the United States. Carranza held on during these years, waiting and hoping, it was generally supposed, for a German victory, and, what is even more remarkable, the oil-fields continued through all this time to yield large supplies, the chief part of which helped to supply the British and American Navies. Disturbed as Mexico might be, oil was now more than ever an essential commodity, and the Englishmen who in small numbers, and often in great danger, were protecting the oil-fields were not merely helping their Company, but, as the Foreign Office expressly admitted,[1] doing a patriotic service of high importance.

Cowdray had other urgent work on his hands during these years, but he was constantly appealed to for advice and received regular reports from Mr. Body. From 1912 onwards the northern part of the Eagle Company's territory—from Tuxpam to Tampico—was repeatedly fought over or raided by insurgents of one faction or another. In September, 1913, a serious emergency arose from President Wilson's advice to Americans to leave the country, for, if it had been taken, the Company's staff must have been dangerously depleted. It was not taken, and Dr. Hayes, the American geologist, who was now Vice-President of the Eagle Company, was able to report that the men were " a unit in ignoring the advice," and that some of them were rendering the most valuable service in directing the feeble efforts of the Mexican Federal authorities to keep order. Since the Mexicans appeared to have only one penalty—that of summary execution—for all offences, Dr. Hayes adds that he had warned his men to be very careful of their facts before making any complaints to the Mexican authorities. Humanity apart, the good relations which had always existed between the Eagle Company and their Mexican employees and neighbours were, as Cowdray and Dr. Hayes realized, the best of all guarantees against attacks on its property.

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[1] " His Majesty's Government consider that the staff of the Mexican Eagle Company are rendering to their country the best service they are able by remaining at their posts in the oilfields."—Telegram from the Foreign Secretary to the British Minister in Mexico, July, 1917.

In November, 1913, Cowdray received by wireless in London the serious news that large rebel forces were holding the camps and might be expected to take Tuxpam very soon. "The rebels," said the wireless, "promise protection, provided we contribute 100,000 dollars Mex. and monthly payment equal to the Federal tax. Pumping stopped pending reply. Threaten destroy property if demands refused or if we request Federal aid. Rebels appear entirely competent carry out promises and threats. Cable instructions." Cowdray replied, giving his agents absolute discretion to do the best they could in the very difficult circumstances, and they succeeded in holding the rebels at bay until the situation changed. The next news was that the Federals were approaching Potrero, and that in view of the probable fighting the great well had been closed down and its valves concreted and all pipe-lines stopped. It now became necessary to evacuate women and children from the camps and to give any men who wished to do so the opportunity of accompanying them to Vera Cruz, which was supposed to be relatively safe. In addition to the damage which the rebels might do, the possibility of American intervention against Huerta and a new kind of war in which Americans and Mexicans—instead of two factions of Mexicans—would have fought over the oil-fields, had at this time to be borne in mind. For the moment, though there were both British and American naval forces at Tampico, it was the opinion of those on the spot that little help could be expected from either. Admiral Cradock,[1] the British, and Admiral Fletcher, the American, were both anxious to do what they could, but neither of their Governments at that moment desired to commit itself beyond affording protection to those who were willing to come into the port and accept the shelter which might be provided for them. As a matter of fact, the camps were rather safer than the port, for in the winter of 1913-14 the latter was the scene of brisk fighting between the Federals and the rebels, and, with gunboats in action, shells were flying in all directions. A letter from Dr. Hayes, the Vice-President of the Eagle Company, who was manfully holding on at Tampico, tells the story in detail at one of its critical moments (December 13, 1913):

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[1] Rear-Admiral Sir Christopher George Cradock, K.C.V.O., who afterwards lost his life in the battle of Coronel, November 1, 1914.

> I am taking advantage of a tank steamer leaving for the States to send you a summary of the recent happenings in this district.
>
> On November 9th and 10th our camps were occupied by a band of Constitutionalists varying in numbers from 50 to 400. All the bands were under the command of General Candido Aguilar, and aggregated about 1,000 armed men, most of them well mounted. They ordered all work to be stopped and made certain demands on the Company with implied threats to destroy property if these demands were not complied with. The demands were as follows:
>
> 1. That we send a responsible official to treat with them.
> 2. That we furnish no fuel to any Mexican railroads.
> 3. That we should not ask for Federal troops to be sent into the oil-fields.
> 4. That we should pay them the sum of $200,000.00 pesos—$100,000.00 down and the balance in monthly instalments of $25,000.00.
>
> Mr. Dewey went down to the field on the 11th, and returned with the above demands on the 15th of November.
>
> After careful consideration and conference with British and American Consuls, I prepared a temporizing reply which Dewey and Armstrong[1] took down to the camps on the 18th. I explained the position of neutrality between the contending factions which the Company occupied, and asked for further time in which to consult the officials of the Company.
>
> In the meantime an attack lasting through several days had been made on Tuxpam, and the rebels had

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[1] W. S. Dewey and J. F. Armstrong, employees of the Eagle Company.

been repulsed, though without much loss on either side.

On the 21st Dewey and Armstrong came in with General Aguilar's ultimatum, which merely reiterated the former demands. After careful consideration we decided that his demands for money were a bluff, and I refused definitely to comply. I agreed not to call on the Government for Federal troops, but pointed out that we could not prevent their being sent. I also agreed that the Company would not furnish fuel to the railroads, but explained that there was sufficient oil in tankage outside the Tuxpam district to supply the railroads for several months, and that we could not prevent the Government taking it and furnishing it to the railroads. This refusal to pay a "war tax" was backed up and our position was greatly strengthened by the warning sent to the rebels by the U.S. Government through Admiral Fletcher. They and we at the time supposed that this warning meant something. We are now convinced that was entirely "hot air." However, it served a temporary useful purpose. During the progress of these negotiations, while General Aguilar was occupying our camps, he preserved excellent order, and our direct losses were food, horses and guns, which he considered contraband. Several of his own men were shot by his orders for looting.

With the arrival of the Federal General Gustavo Maas at Tuxpam, the rebels quietly faded away, concentrating first at Amatlan and then going north with the avowed intention of taking Tampico.

On Friday, December 5th, I received a wire from Mr. Ryder[1] urging me to call on Admiral Cradock at Tuxpam. This was the first intimation I had that I was expected to call on him and that he had come to Tampico with any special reference to Aguila (Eagle) interests. I went down to Tuxpam Saturday, the 6th, in the midst of our first "norther," and waited there until Monday evening, when I learned that he did not intend to stop at Tuxpam. I visited Tumbadero, where 200 Federal troops were quartered, and Tanhuijo, reaching Tampico on Tuesday evening. On Thursday I met Admiral Cradock, and satisfied him that there was no intentional discourtesy in my failure to call on him during his previous visit.

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[1] Mr. T. J. Ryder, later President of the Mexican Eagle Co.

The Constitutionalists had demanded the surrender of Tampico on the 7th, but no one paid any attention to the demand. However, they were reported on the 9th advancing in force from the north, and Wednesday morning, the 10th, they began to attack. The Federal lines were forced back to the vicinity of the cemetery, north of town, and to the Cortadura Canal, at the Tampico Navigation Company's terminal on the east. Everything east of this, including Dona Cecilia, El Aguila, the Refinery and La Barra, was occupied by them. It is quite certain that the Federals were badly demoralized by the first day's fighting, and if the rebels had pushed their advantage they could have taken the town easily. Fighting continued all of Thursday and Friday and until about three o'clock this morning. To-day there has been no firing, and I am just informed that the rebels have retired beyond Altamira. Yesterday Federal reinforcements were sent in by rail from San Luis and on the gunboat *Veracruz*. The *Bravo* was already here, and it was undoubtedly the fire from these two gunboats which prevented the capture of the town.

In my first interviews with Admiral Fletcher, November 26th and 28th, I was led to believe that the United States had adopted a firm policy with regard to the protection of foreign lives and property in the oil-fields. In subsequent interviews there has been continual qualifying and hedging, until in my last interview I was practically informed that the United States Navy would give absolutely no protection to property, and none to foreigners unless we should come down and camp out on the Fiscal Wharf. British subjects were provided refuge and accommodation of a sort on the freighter *Logician* and German subjects on the *Kronprinzessin Cecilia*. After careful consideration we decided that Aguila employees were quite as safe in the Aguila building as anywhere else, and a large majority of them with their families have spent the past three nights here. We have taken all necessary precautions against possible rioting, which I have not considered probable at any time. We are thoroughly organized with military discipline, and have felt quite safe—and we certainly feel more self-respect than we would if we had abandoned everything on the advice of the Admirals.

I cannot speak too highly of the loyalty and steadiness of all the Aguila employees throughout the rather trying experiences of the last month. It is difficult to select some for honourable mention where all have so uniformly come up to the demands of the occasion. To Dewey, Armstrong, Craig and Steel should be given much of the credit for the successful handling of the rebels in the field. They all displayed conspicuous courage, firmness and tact. During the past week Phillips has been my right-hand man here, ably seconded by Fox, Van Horn, Chamberlin, Padel and many others.

Our principal direct losses during the siege have been in the Colony, where the heaviest fighting took place. The ranch-house, which was occupied by our Colony Manager and Engineer, has been damaged beyond repair by shells from the Federal gunboats. Also most of our mules were killed and the orange orchard badly damaged.

Work at the Refinery was not entirely suspended at any time, since I considered that the moral effect of keeping things going was worth while, even though little was actually accomplished. Fortunately, our telephone lines were not cut, so that we have been in touch with the refinery and the fields at all times. Of course our passenger and freight service has been out of commission, and we have had great difficulty in getting provisions down to the refinery. At first, the American Admiral sent provisions down in one of the naval launches, but later refused.

> Of course the work of this office has been thoroughly demoralized, but I hope to get things in working order again to-morrow.

A week later Dr. Hayes wrote again :

> Everything remains quiet here and in the fields. The only exception is at Bustos, near which place a band of about 60 is encamped. They claim to be under Aguilar ; but they are probably a semi-dependent band of bandits. They have robbed the station and prevented pumping ; also repair of a break between San Diego and Bustos. Hence we have had no oil deliveries in Tampico for the past week.
>
> The location of Candido Aguilar's forces cannot be definitely ascertained, but he is probably somewhere between here and Ozuluama.
>
> The rebels retired beyond Altamira after their unsuccessful attack on Tampico, taking with them five locomotives, seven passenger coaches and other rolling stock. They are also reported to have secured two wagons of ammunition and dynamite at Don Cecilia. They did not consider themselves defeated and were not in the least demoralized in their retreat as reported in the papers. They made no secret of their intention to return and take Tampico, announcing as part of their plan the burning of the Waters Pierce Refinery and other oil in tankage along the river to drive the shipping from the harbour. If they return they will doubtless bring artillery and shell the town.
>
> In the former attack it was planned that Aguilar should cross the Panuco river and cut the railroad to San Luis. His failure to do so enabled the Federal garrison to be reinforced. They will probably see that the road is cut if they come again.
>
> If the rebels do not renew the attack on Tampico, I apprehend that Aguilar will return to the oil-camps with his forces and renew his demands for money. We shall endeavour to meet conditions as they arise, and protect the interests of the Company to the best

> of our ability. I fear, however, that we have a rocky road to travel immediately ahead.
>
> I am convinced that we have absolutely nothing to expect in the way of protection to our property from the American or British naval forces. The positive assurance given me by John Lind amounts to nothing, and I fear Aguilar will learn that the warning sent him was only an empty bluff.
>
> I am sending you cables whenever there is anything definite to report, and when I can get them off. The federal lines are cut most of the time, and the American ships object to sending radiograms for us.
>
> The strain is beginning to tell on the efficiency of the organization, both in field and office. I trust you will not be expecting too much in the way of results until conditions become normal. (Tampico, December 19th, 1913.)

Dr. Hayes was a little more pessimistic than he need have been about the help to be expected from the British fleet, for in April, 1914, when the rebel attacks on Tampico were renewed, he reports that he " cannot speak too highly of the efforts of Admiral Cradock and Captain Doughty " (Captain of the *Hermione*), and a week later Mr. Body cabled that the Admiral was volunteering to go himself with his staff and a flag through the oil-fields and convince all parties of the expediency of neutrality for the good name of Mexico and its international relations. Mr. Body added that " foreign interests in Tampico should build a house of gold for Captain Doughty of H.M.S. *Hermione* for the manner in which he has been able to save life and property," and Dr. Hayes paid a similar tribute to the same officer :

> It is largely due to the assistance of Captain Doughty that the Eagle Company has been able to continue its most important operations without serious interruption.
>
> I feel under great obligations to him both personally and on behalf of the Company. I trust his tactful,

> courageous and intelligent handling of an extremely difficult situation may receive the recognition that it merits.

In the end all the foreign Admirals, including the American, appear to have stood together in advising their nationals not to pay the blackmail demanded by the rebels, who for the time being refrained from pressing their demands.

So it went on with improvements and relapses, periods of calm and periods of agitation, for the next four years. The American punitive expeditions made a specially difficult situation for the American employees of the Eagle Company, and most of them took refuge in the ports when they could rely on the protection of warships. There were for a time two Governments in Mexico, the Government of Carranza and the Government of Villa, and both tried to levy toll on the oil-fields, and curried favour with their supporters by denouncing the foreigners and threatening to confiscate their property. In 1915 a decree of Carranza's declared all titles invalid since 1876, and forbade work without express permission of his Government. Mr. Body, who was in London at the time, wrote to an agent of the Company, after conferring with Cowdray, an outline of the case which was to be made in answer to these and other threats:

> That the Mexican Eagle Company, without proper protection such as was given us by our Federal concessions, could not have gone into this oil business and have risked the enormous amount of money which it did in exploring for oil; that, when this was obtained, it incurred a further huge expense in transporting the oil to the coast and thence across the seas; that it has organized big sales companies with the enormous capital required for stations in all parts of the world in order to dispose of the oil; and invested huge sums in Mexico in its refineries.
>
> That it is one thing to follow on the heels of a successful company when the country is developed, but quite another to spend—as the Chief has done—half his working life in proving the possibilities of the

country and maintaining such strenuous efforts until commercial production is at last gained.

That the huge financial resources we have had to draw upon to assist us in the development of the country have only been gained on the strength of our concessions. Investors are chary of laying out their money in a raw country unless some protection is assured. We have probably not less than 20,000 shareholders in the Eagle and its affiliated Companies; these shareholders have been induced to go into the business mainly on account of Lord Cowdray's personality and the belief that the contracts entered into by him with the Mexican Government would always be respected.

Heavy taxation at this moment would retard and probably entirely prevent these new developments so necessary to maintain the huge task we have essayed, and would so severely handicap us that our undertakings might be mortally crippled, and we should seriously have to consider whether we should not have to close down. Further, failure of the Government to respect the concessions granted to us would prevent us raising new capital for the extension of our work, and, still more, would react so unfavourably on financial circles as a whole that the credit of Mexico would be gravely prejudiced to her immense detriment in the future.

That the huge profits with which the uninitiated credit the oil business live only in their imagination. The business requires the utmost economy in its management, otherwise disaster would follow. After ten years, during which our ordinary shareholders have received no dividend, we are only to-day in a position to pay the nominal amount of 8 per cent. It will take many years to show those who have patiently poured out their money even a reasonable return for this long period of waiting.

That we fear no impartial investigation as to our position with regard to any political faction in the country, nor as to the correctness of our attitude in dealing with the Mexican or any foreign Government.

These remonstrances, backed by firm language at Washington, appear to have prevented any of the factions from doing irreparable damage to the oil-wells, but it needed rare nerve and courage to keep at work during the turbulent period and dangerous incidents were frequent. In March, 1916, the Potrero camp was raided by a band of Mexican soldiers, believed to be Indians, and a Mexican employee of the Company taken and summarily shot. In March, 1917, two Englishmen, Mr. H. W. T. Buckingham, the superintendent, and Mr. B. E. Campbell Bannerman, the cashier, of the Nanchital camp, were killed by another body of armed raiders. In 1918, soldiers out of control appeared in the northern fields demanding money and provisions on the plea that they had nothing to eat and had had no pay.

Cowdray wrote often in these years to members of the staff encouraging them and expressing high appreciation of their services. One of these letters addressed to Mr. T. H. Vaughan, the engineer in charge of construction work, pipelines, etc., may find a place here :

> I was much disappointed to hear you had changed your intention of taking a holiday—splendidly earned and no doubt well needed—as it showed fresh difficulties, or fresh possibilities of them, had arisen.
>
> You have had a time of difficulty and danger, and one requiring both physical and moral courage, clear vision and sense of proportion, enduring patience, alertness and strenuousness, and I am thankful to say and have much pleasure in recording that you fully met the demand.
>
> This letter is not meant as a substitute for a holiday. But I have been intending to write you, and through you your co-managers, to express my gratitude to you all for the truly fine manner in which you have overcome dangers, difficulties—nay, wellnigh impossibilities—put out fires, capped wild wells, kept the business going, the property intact and the staff in fine heart, etc., etc., etc., at a time when failure of any of the fine traits of character named would have meant disaster.

> You are doing your duty to the State as much as the men at the Front are doing it. You are equally upholding the flag—although in a different way—and I am as proud of my army as any general could be or has ever been. (June 18, 1915.)

In spite of everything, the Company prospered. Dr. L. Weston who was in charge of all the Refinery operations of the Mexican Eagle Company remained indefatigably at work; the wells gave abundantly, and the demand for oil and more oil came from all over the world. The British Admiralty alone was taking 200,000 tons a year. But with all the other burdens that he now had upon him, Cowdray felt that he could not continue to carry this one single-handed. He had worked for nine years as a pioneer, pouring out his money without any return; he had fought and overcome the powerful interests which, as soon as success came in sight, threw themselves in his path; he had won through and found himself in possession of a great and wealthy property, only to encounter new and unexpected difficulties. With the revolutionary troubles in Mexico and the perplexing political problems that attended all questions touching the protection of foreign interests in that country, it seemed to him that he must either devote his whole time and energy to this part of his business or find more powerful support than he could bring to it consistently with his other interests and duties.

The thought was not a new one, nor did it come only from his side. From the time that it was evident that he was going to succeed, would-be buyers or partners had been only too anxious to share his good fortunes. Two overtures were made to him by the Standard Oil Company in 1913, one by the President, Mr. Archbold, who spoke of acquiring the Mexican Eagle Oil Interests, but drew back a little later on the ground that " legal and political difficulties " required its postponement for the time being. Since the British Admiralty had by this time a large interest in the regular supply of oil fuel from the Mexican fields, Cowdray felt it to be his duty to keep the Government informed of all transactions affecting their ownership, and in December, 1913, he laid a frank statement of the position before Mr. Lloyd

George, who was then Chancellor of the Exchequer.[1] He was prepared, he said, " specifically to dedicate " the Mexican Eagle Company to the primary purpose of supplying the Admiralty with oil, but in that case they would have to look to the Government for financial assistance instead of selling their securities to the public. In effect his proposal was that the Government should put in £5,000,000, in return for which the Company would " undertake not to sell its interests and to give the Government such security for the money as would be a full *quid pro quo* for their assistance and would be satisfactory to the House of Commons."

Nothing came of this, and three years later, in 1916, he drew up a memorandum urging the formation of a British Imperial Oil Company to secure and develop the oil requirements of the Empire, such as could be created by the amalgamation of the Mexican Eagle Oil Co. with the Anglo-Persian Oil Co. and the Burmah Oil Co., with a certain amount of Government assistance at the outset, but this also failed to find favour with the Government. In November, 1916, the Standard Oil Company reopened negotiations, and by February in the following year they had reached a point at which it became necessary for Cowdray to ask the Government for its views, with the result that he was urgently requested to discontinue the negotiations, and threatened with D.O.R.A. if he pursued them. Anxious as he was not to embarrass the Government, Cowdray felt that it had placed him in a very unfair position when it would neither share his burden nor permit him to share it with others, but he had no remedy, and the mere invocation of D.O.R.A. was sufficient to stop the Standard Oil Company from proceeding further.

But there were other bidders in the market, and principally the Royal Dutch, which also quite early in the day had been feeling its way to some arrangement. Cowdray, after 1916, remained passive, and when the war ended and the conditions in Mexico improved, he became less anxious about sharing his burden. When, therefore, an accredited agent of the Royal Dutch approached him in October, 1918, the initiative was entirely on their side. Now the proposal was the simple one that they should buy a considerable number of ordinary shares, of which the bulk was then held by the Pearson Firm, and " assume the responsibilities of management, leaving Lord Cowdray in a perfect peace of mind." The basis of the bargain as carried through was a valuation of the ordinary shares, and as a result of this sale the Royal Dutch Group took over the management control of the company early in 1919. At the same time the Cowdray interests retained a large holding and the family are to-day by far the biggest shareholders in the Company.

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[1] He records that in his interview with Mr. Lloyd George he " explained that £5,000,000 were invested in the oil-fields, plus the £3,000,000 invested or to be invested for the Bond proceeds, making a total of £8,000,000 ; that the Transport Company's boats had cost £3,000,000, and that the selling facilities would cost £1,000,000 ; making a total of £12,000,000 of capital invested ; that the shares to-day, notwithstanding the adverse conditions in Mexico, stood at £5,000,000 premium."

During the two subsequent years a boom in oil shares of all kinds took place, and Mexican Eagles were caught up in the speculative fever. In 1922 an unexpected invasion of salt water into the fields caused much trouble and had a very serious adverse effect upon the fortunes of the Company, but between 1919, when the sale was effected, and 1922 when this set-back was encountered, the Company's annual production had risen from 18,700,000 barrels to over 32,000,000 barrels.

When the transaction with the Royal Dutch Group had been completed, Cowdray sent a signed portrait of himself to his " partner and friend," Mr. Body, and wrote :

> It was you who carried the burden of my Firm's huge Mexican interests from 1895, when the construction was commenced of the Harbour Works at Vera Cruz, until 1919, when the Mexican Government had perchased our partnership rights in T.N. Railway and when we sold our Eagle Oil holdings to the Royal Dutch-Shell Group.
>
> During this period you were a pioneer, and in districts notoriously unhealthy, of vast enterprises that became great successes.
>
> Your self-sacrificing devotion to your work has been a great example to all your associates.

CHAPTER XVIII

UNDERTAKINGS AND EXPERIMENTS

Electrical Enterprises in Mexico and Chile—The Whitehall Electric Investments Company—Other Oil Enterprises—Colombia and Costa Rica—China and Argentina—Prospecting in Great Britain—Cowdray's Offer and its Acceptance—Criticism in the House of Lords—Cowdray's Answer—Inconclusive Results—The Amerada Corporation.

COWDRAY'S insatiable energy and appetite for new undertakings are in nothing better illustrated than in the development of the Firm's electrical undertakings, which went on continuously during the years of greatest stress in his oil enterprise. The beginning, as already recorded, was at Vera Cruz, where, after the completion of the harbour and port works, he was asked by President Diaz to take over the local tramway system and electrify it. This was not up to that time his line of business, but the President was convinced that the Englishman could do anything and saw in him the appointed instrument for the modernization of Mexico. The Englishman was willing, but he needed expert advice, and having noticed the excellent work done by a Canadian, Mr. A. E. Worswick, who had just completed the construction of the Mexico City electric tramway system, with its one hundred miles of track and steam power plant and modern equipment, he asked him to go to Vera Cruz and report. Mr. Worswick not only advised on the reconstruction and electrification of the tramways, but recommended that the existing electric light and power business should be acquired and reconstructed at the same time. As a result, the whole work was undertaken and carried through by a company formed for the purpose (the Vera Cruz Electric Light, Power and Traction Limited), in which the Firm took the principal interest, and Vera Cruz found itself in the forefront of electrical enterprise.

Cowdray next turned his eye on the electric power supply for the Santa Gertrudis Jute Mills in Orizaba, in which he had been associated with his brother-in-law, Mr. Kinnell, and there too, on Mr. Worswick's advice, a new electric power plant was installed which enabled the capacity of the plant to be trebled. From this time forward Cowdray and Mr. Worswick, who now became a regular member of the Firm, were keenly on the watch for new openings; and about 1904 they set to work on the City of Puebla. Here Cowdray bought out an existing American-owned company which was supplying power in bulk to the local distributing company, and having reconstructed its plant, presently unified the undertaking by acquiring the distributing company and bringing it under the existing Puebla Tramway, Light and Power Company. In the next three years another hydro-electric company was absorbed by the Puebla Company, a second power plant built near Puebla, and the hydro-electric development of the Tuxpango Falls near Orizaba taken in hand. From the new plant, transmission lines were built both to Vera Cruz and Puebla, and a little later the electric light and power companies of Orizaba and Cordoba were purchased and joined up to the main Puebla system. These various operations constituted together an admirable example, at a comparatively early stage, of modern hydro-electric development and transmission of power.

About the year 1911 it had become evident—with the coming in of the great Potrero wells—that the port of Tampico was to become a highly important centre for the oil business, and Mr. Worswick advised his chief to buy the tramway system and two competing electric light companies. They were all in a physically bad condition, and it was decided to construct a new steam plant and lay down a complete distribution system. As time went on, the demand outgrew the capacity of this first plant and a new and much larger one was constructed. All these enterprises prospered up to the outbreak of the revolution, but then for a period they fell on anxious and difficult times. With the depreciation of the currency and the incessant labour troubles, the earnings of some of them were wiped out and the future of all were in doubt. But Cowdray stood by them through these adversities, and from 1916 onwards, when the country became calmer, they recovered and have continued operating successfully to the present time.

Though in some respects it anticipates, this part of the story may be carried on to its conclusion from this point. After he had eased the burden of his oil responsibilities, Cowdray began to look for electrical investments in other countries than Mexico. One such opportunity came when the Public Trustee at the end of the war offered for sale the whole of the capital stock of the Chilian Electric Tramway and Light Company. This company had been originally formed, about the year 1898, by Wernher Beit & Company, to take over the horse tramway and electric light system of Santiago, Chile. The tramways were electrified, but shortly after the first construction programme had been completed, Wernher Beit & Company sold the business to the Allgemeine Electricitäts Gesellschaft of Berlin. The old English company, however, was kept alive, and practically the whole of the capital stock belonging to the Germans, and carrying German control, had been left on deposit in a German bank in London and was therefore forfeit to the British Government. Cowdray bought it and put its development in hand without delay. The Santiago system was found to be in a deplorable condition, since practically nothing had been done to keep it up since the beginning of the war. Indeed, so great had been the need that a local Chilian company, the Cia. Nacional de Electricidad, had been formed to develop a hydro-electric scheme on the River Colorado about forty miles from Santiago. This company was absorbed by the new company, the Cia. Chilena de Electricidad, which Cowdray formed. Having great confidence in the future of the country, he now proceeded to spend lavishly on all branches of the work, first bringing to completion the great Maitenes hydro-electric scheme in the high Andes, and then, when its full output had been absorbed, starting another known as the Volcan on the Rio Maipo at Queltehues, which came into service after Cowdray's death during the year 1928.

In the meantime (1922), the Electricity Supply Company and Tramway system of Valparaiso had been bought from its Spanish owners and large sums spent in reconstruction. A transmission line from the Maitenes power plant in the Andes brought an abundant supply of power to Valparaiso and other smaller towns on the way. From time to time other Electricity Supply Companies in the smaller towns were acquired and joined up with the general distribution system of the Cia. Chilena de Electricidad, which now serves a population of more than a million in the central region of Chile. The advantages to the country of this development were beyond all doubt. The advent of cheap power gave great stimulus to industry and added immensely to the comfort and convenience of the people. The Government was enabled to electrify the main line of railway between Santiago and Valparaiso, and between Valparaiso and Los Andes; and the Transandine Company to do the same for the rack section of its railway over the Andes. The Chilian electrical enterprises thus proved successful and profitable to all concerned.

All these electrical enterprises were grouped together under a parent company known as Whitehall Electric Investments Limited, of which Mr. Clive Pearson is the Chairman. In this the Firm holds the ordinary shares, while debentures and preference shares have been issued to the public. At the beginning of the year 1929, the Mexican and Chilian enterprises were disposed of to American purchasers, but the company is pursuing its electrical enterprises in other regions and is now seeking statutory powers for the development of a large area in Devon and Somerset in which various subsidiary undertakings will be linked up by high tension transmission lines extending the services to the adjacent towns and villages.

Cowdray by no means lost his interest in oil production when he ceased to control the Mexican Eagle Company. As far back as the year 1912 his Firm had created an Oil Department to prospect for oil and deal with any properties they might acquire outside Mexico, and in 1919 the Whitehall Petroleum Corporation was formed, with Lord Murray (who had recently joined the Firm) as Chairman, to take over the work of this Department. There is no known reason why oil should be limited to any one part of the world or be found only in one latitude, and the Department—and subsequently the Corporation—went prospecting all over the world: in Canada, China, Colombia, Costa Rica, Algeria, Argentina, France, Greece, Mesopotamia, Morocco, Tunis, Hungary, and finally in England itself. From first to last they spent a great deal of money and during the war when the Allied Governments were becoming alarmed at the prospect of a shortage of oil for their fleets, armies and aeroplanes, they displayed much patriotic enterprise without thought or prospect of profit. In the end the commercial results were almost nil. Oil was often struck, but not in commercial quantities, and where it promised to be abundant there were generally political difficulties or opposing interests which were too formidable to overcome.

It is impossible to deal in detail with all these enterprises, but a few may be briefly described. In 1913, on information that the prospects were good, a special mission, of which Lord Murray was chief and Mr. M. G. Ribon a member, was sent to Colombia, and after prolonged negotiations signed a contract at Bogota with the Minister of Public Works, with the approval of the President and Council of Ministers. Under this contract the Government undertook to reserve to S. Pearson & Son for exploration an area selected by the Firm which at any given moment was not to be more than 10,000 square kilometres, but which might be kept up to that amount by the addition of new ground as the original ground was tried and relinquished. The period of exploration was to be six months, renewable by periods up to a total of two years, and when finally the Firm had selected its areas for development, a concession was to be granted for forty years. The Firm undertook to spend a certain sum of money in five years and to pay a royalty of eight cents per ton in commutation of all taxes and charges on oil obtained from Government land and five cents per ton on that obtained on private land.

It seemed a fair bargain, and the contract passed its first reading in the Colombia Congress on July 24, 1913, and was referred to a committee for consideration. Then trouble began. The committee suggested various modifications in the contract, all of which were accepted by the Firm, but without the expected result of removing the block. It now appeared that the General Asphalt Company of New York was on the scene, and though its proposals were no more favourable to Colombia than those of the Firm, it had strong backing from the United States Government. The Colombian Government was in truth in a very awkward position. It was engaged at that moment in negotiations with the United States Government regarding the compensation to be paid to it for the seizure by that Government of the Panama Canal zone, and it supposed, probably with good reason, that its interests would be gravely prejudiced if it ran counter to American wishes on the oil contract. On the other hand, the Pearson proposals gave it a certain lever, which it was quite willing to use, in obtaining terms from the American Government. Before many weeks had passed, Cowdray perceived that he was becoming a pawn in the Panama negotiations, and since he had no wish to occupy that position, he withdrew the contract (November 24, 1913) and the mission left the country. He put it on record at the time that " the American Government did not scruple to bring diplomatic pressure to bear upon Colombia to such an extent as to prevent the Colombian Government ratifying the contract it had made with us for the exploration of oil in that country." " They have brought similar pressure," he added, " to bear on two other American countries in which we were prospectively interested." It is only by experience that prospectors and contractors discover the workings of that economic penetration which is thought in the United States to be the proper accompaniment of the Monroe doctrine.

One of the other " two American countries " which Cowdray was thinking of was, no doubt, Costa Rica, where the affair ran a similar course. There also what appeared to be a fair bargain was held up by the Costa Rica Congress and finally rejected in secret session for fear that the granting of the concession to a British firm would prejudice negotiations then pending about its boundary dispute with Panama. In Ecuador local obstruction and intrigue combined with American opposition to hold up another scheme, which also had to be withdrawn. The result of these experiments was to make it clear that the smaller Central American Republics must be written off the map, so far as the British prospector was concerned. But oil everywhere by this time roused local and patriotic feelings, and though the firm persevered during the years of war at the instigation of the Allied Governments, it got little help at critical moments from those which had invoked its assistance.

In China, where the Firm had sent its representative, Mr. R. Anderson, in 1915 to take part in an exploration, a promising contract at one moment seemed possible. But when it came to business, the Chinese Government put in the condition that it should be provided with an immediate loan of £1,000,000 sterling. When the matter was referred to the British Treasury, it naturally wanted to know in what way and on what terms the money was to be raised, and since no one knew the answer to these questions, both loan and contract fell through. In Algeria, where the Firm had acquired a controlling interest in the Oran Oil Company, a large area was studied and mapped in detail by a staff of geologists, but the concession, though approved and initialed in May, 1916, by the Minister of Public Works, was never formally ratified. In the following year when it had become extremely desirable to obtain a supply of petroleum for the Allies on the shores of the Mediterranean, the French Ministers of Public Works and Marine strongly urged Cowdray to go ahead, and under that pressure he decided to do so without waiting for the approval of the contract, and incurred heavy expenditure on drilling machinery which had to be bought at fancy prices in the United States and transported at a cost which amounted in some cases to £35 per ton. Unfortunately, this spirited effort was not rewarded. Very little oil was found; the concession remained unratified, and in 1923, when the affair was wound up, the French company with which it had been operating owed the Firm more than £100,000, which had to be written off along with the capital invested.

In Argentina a draft contract for working the oil-fields in partnership with the Government was concluded, but was vetoed by the President of the Republic, presumably on political grounds. In Canada, an attempt was made in 1920 to come to terms with the Canadian Pacific Railway Company for the development of a block of their lands, but broke down on the terms of the lease. In the meantime a corps of geologists had been sent out which, in the summer of 1920, worked out the geology of the foothills district from the United States border in South West Alberta northwards to the Peace River and the Athabasca River. But the results were dubious, and in this case also the Firm concluded that the leases obtainable were not such as to justify a large expenditure on a very speculative venture.

But the most interesting of these experiments was undoubtedly the attempt to find oil in Great Britain. In spite of the general opinion which placed Great Britain off the oil-map, Cowdray had always thought that an exploration would be worth while, and even before the war had set his geologists (of whom Dr. A. C. Veatch was at this time the chief) to work on special investigations in the Midlands, with the result that certain districts were selected as worth exploring. Negotiations were then entered into with the landowners to arrange leases for testing, and if the tests were successful, for the production of oil on their lands. These, however, had to be suspended in August, 1917, when the Government introduced a Bill reserving to the Crown the exclusive right to search and bore for petroleum in the United Kingdom. A sharp controversy ensued as to whether this would be in the public interest and whether it would accelerate or retard the production of oil, which by this time had become an urgent matter. This Bill was ultimately withdrawn, and, on Cowdray's suggestion, another substituted for it, which left the question of the final ownership of oil, if found, in suspense, but gave the Government the power to control the process of drilling by the issuing of licences, and so to prevent the waste which might occur by indiscriminate drilling. Conditionally on this Bill being passed, Cowdray now offered to place the whole of his investigations since 1914, together with the services of his Firm and technical staff, without charge or profit, at the disposal of the Government, and in September, 1918, the Firm was appointed Petroleum Development Managers for the Ministry of

Munitions. There were suspicious people who were incredulous when told that a great business firm was prepared to work without profit on a national enterprise, and it was alleged in some quarters that Cowdray had astutely manœuvred the Government into giving him a practical monopoly of oil production in Great Britain. When the Bill was debated in the House of Lords, the Duke of Northumberland was hot on this scent, and Cowdray answered him with much spirit :

> Our knowledge of the subject taught us that to allow drilling over small areas without any control meant disaster in a country of this kind. We have to remember that, compared with America, England is a very small country, and the probabilities are that our oil resources will be correspondingly small. Thirty years ago the total production of oil in America was only four million tons a year. To-day there is a little over ten times that quantity, and the American Government is very disturbed because it believes that in another twenty-seven years the oil in the United States will be exhausted. Knowing this, when I was asked by the Admiralty to commence drilling on small areas, without there being any control as to the methods of drilling, I declined. I thought I would rather have the odium attached to me of declining to proceed with drilling at a time when admittedly it was necessary, than ruin an industry which in my opinion is vital to the interests of this country.
>
> What happens from promiscuous, uncontrolled drilling ? I have seen in the United States, on an area the size of this Chamber, two or three rigs each competing and trying to extract the maximum quantity of oil from the reservoir below, simply through their having that small ownership, on which they have put two or three rigs. Of course the result is that the surrounding owners naturally begin to put holes down themselves to protect their own interests, and this goes on, drilling against time, putting four or five wells down and sometimes more, where one would do.

To get the oil from the ground to the maximum extent possible, it is necessary to conserve the gas-pressures. It is the gas which forces the oil from the strata, or the caverns, whatever it may be, to the well. It is not the natural flow of the oil to the well that brings any great production. If you once lose the gas-pressure, you lose half or even three-quarters of the oil in the ground; and how can you conserve the gas-pressure when you have indiscriminate, uncontrolled drilling—five or seven or even ten wells where one would do, and each exhausting the gas? Again, another danger is that you may flood the oil-fields. If you admit water from the upper strata into the oil deposits you send your oil heaven knows where. It is lost.

Knowing these things, I declined to drill unless the Government protected the industry by legislation. By "protected" I mean controlled it—regulated the number of wells that should be put down and the method in which they should be put down. Of course, this was quite contrary to my interests and my policy. I had hoped to secure leases over the oil areas. I had expected a Rockefeller fortune. The needs of the country demanded that I should make the sacrifice, and without a second's hesitation I offered the whole of my knowledge and help to the Government, provided the Government did what I believed it was essential they should do—namely, look after the industry. The Agreement is the result. Under that Agreement we give all the knowledge we possess. We give all the services we can, because we give the services of our geologists and of my colleagues and office. We give the knowledge we have, the discovery which we have made, and every effort that we can make. And what do we get? We get accusation in this House, as if I were not giving something, not making one of the handsomest presents man ever made to his country, but as if I were trying in some way or other, by some scheming, to get some personal advantage. The contrary is the case. Under that Agreement it is impossible for me to get one cent out of the Govern-

> ment. It is impossible for me to have any monopoly. There is no monopoly as far as we are concerned. We are agents of and working for the Government. Our information is theirs, and when we have finished we have to make our bow. We expect to get thanks, because we believe we shall produce oil. We are certain, in fact, that we shall produce oil, but the uncertainty is as to the quantity that we shall produce. About our producing oil there is no doubt, and at the finish when we have produced oil, we hope that some of these unworthy thoughts that have been expressed will give place to an appreciation of what we have done. (House of Lords, Nov. 6, 1918.)

In the same debate Lord Elphinstone, speaking for the Ministry of Munitions, warmly denied either that Cowdray had sought a monopoly or that the Ministry had provided him with one:

> One thing I can say with absolute confidence, and that is that I am quite sure that Messrs. Pearson, from a purely selfish point of view, would have been in a very much better position to-day if this Agreement were not in existence, and if they were working on their own account with their own money and reaping the benefits for themselves. I feel that the position is really this. Had it not been for this Agreement, it would have been possible for Messrs. Pearson to create for themselves a position which would have resulted in their having a virtual monopoly; and for this reason—they were the only firm who have carried out any research work on an extended scale in this country, which means that they have four years' start of their rivals. Had they been working for themselves they could have got control of all the most likely areas for themselves, and if oil were discovered I think there is no doubt that they would have made probably a very large fortune. That is not the position to-day.
>
> What are the facts that we are dealing with under this Agreement? Messrs. Pearson are working on behalf

> of the Government without any remuneration whatever. They cannot make a single penny out of that Agreement. Is that a monopoly in favour of this Firm ? It is not a monopoly that many people would like. As your Lordships will see from the Agreement, they have voluntarily placed at the disposal of the Government, free of any charge, so to speak, their own services and experience, the services of an expert staff, and, what is of even greater value than all that, the knowledge that they have accumulated in the four years of research work which they have carried out in this country. The whole of the plant used by them is the property of the Government. In these circumstances it seems to me that, if there is any monopoly at all in the Agreement, it is a monopoly not in favour of Messrs. Pearson but in favour of the Government.

A paragraph in the Agreement which put the Pearson Firm in the same position as all other firms at the end of the experimental period had been construed as giving the Firm a special privilege. Upon this Lord Elphinstone said :

> I have seen this paragraph in the Agreement referred to as proof positive of the nefarious designs both of the Government and of the Firm of Messrs. Pearson. But surely, my Lords, nobody is prepared to say that, having made the offer that Messrs. Pearson made, not only were they not to receive one penny remuneration for the whole of their work carried out under the Agreement, but that they were to be absolutely penalized for doing so by having refused to them the same rights which were open to all other competitors in that industry ; that while they were working for nothing for the Government they were to stand aside and watch other firms applying for, and possibly getting, licences to work the oil which they, Messrs. Pearson, had been the means of discovering. I cannot believe that this could really be argued.

The sequel proved what no one who knew Cowdray had ever doubted that his action in this matter was wholly disinterested and patriotic, and not the less so because his hopes proved to be too sanguine. In the next three years he acted loyally up to his pledge to give his services and those of his staff without remuneration, while the Government grant of £1,000,000 was applied to the bare cost of drilling and providing the necessary plant.

Before the Bill had passed, he had ordered the plant, and engaged an expert drilling personnel in the United States, and actually started drilling at Hardstoft, near Chesterfield (October 15, 1918). The first results were encouraging, and in the following May, oil of high quality in what looked like paying quantity was struck at a little below 3,000 ft. This continued to flow at the rate of about thirty-six barrels a day till 1922, when it suddenly declined to about a third of that quantity, whether from an accumulation of wax at the outflow, or from an exhaustion of the oil, was not determined. Nevertheless nearly a ton of oil of Pennsylvania quality per day has been got from this Hardstoft Well from the time that it came in in 1919 up till now. Eleven other wells were drilled,[1] but none of them gave commercial results within the time allotted, and when the drilling had passed the levels at which oil was expected they were given up. By the year 1922 the sum voted by Parliament was exhausted, and the

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[1] These wells were:

Ironville, Nos. 1 and 2 at Codnor Park and South Normanton in Derbyshire.
Heath No. 1 at Heath in Derbyshire.
Brimington No. 1 at Brimington in Derbyshire.
Renishaw No. 1 } at Eckington in Derbyshire.
Ridgway, No. 1 }
Apedale Nos. 1 & 2 } near Stoke-on-Trent, Staffordshire.
Werrington No. 1 }
West Calder, No. 1, 20 miles S.W. from Edinburgh.
D'Arcy, No. 1, 2 miles S.E. from Edinburgh.

The depths reached varied from 884 feet at D'Arcy to 4,006 feet Ironville, No. 2.

For a technical account of these wells see the American periodical *Mining and Metallurgy*, October, 1923, "Recent Exploration for Petroleum in the United Kingdom," by E. L. Ickes, at one time member of the staff of S. Pearson & Son. Mr. Ickes summarizes the results by saying that of the wells sunk, "two yielded encouraging showings: three cannot be considered as having been adequately tested; and five produced dry holes, although in some of these small oil showings and gas were met."

Government took the view that the experiment was a wartime measure which must be wound up. By this time all anxiety about oil supplies was over, and with oil flowing abundantly elsewhere, there was no necessity to develop a home supply. Cowdray's investigations certainly did not encourage the hope of any " Rockefeller fortune " on English ground, but experts considered them well justified, and are still of opinion that they will prove of value in future years. When the long effort and large expenditure that have been necessary to achieve success in other countries are borne in mind, it is impossible to say that this one experiment has proved the negative for all time. American oil experts who watched this experiment have declared their opinion that any similar results on American ground would have been followed up energetically until oil had been found in paying quantities, and have expressed themselves in somewhat caustic terms about the lack of enterprise in Great Britain.[1]

The reports from the other countries—Haiti, Honduras, Egypt, Palestine, Nigeria, Portugal, India, Labuan, Morocco, Mesopotamia—were monotonously the same. Either, as in Mesopotamia, the ground was occupied, or the prospects were poor, or secure leases were unobtainable, or the terms asked by Government and landowners were unacceptable. Many sanguine dreams were shattered by the cool survey of geological experts. In the United States alone was there found any commercial reward for all this effort. There the Amerada Corporation, in which the Firm had a 60 per cent. interest, had great success on the " semi and proven " and " wild-cat " lands in Oklahoma and Kansas (and subsequently in Louisiana, Arkansas and Texas) acquired by Cowdray's colleagues, Messrs. Body, Ryder, Carr and De Golyer ; and dividends have risen from 10 per cent. in 1921 to the equivalent of 20 per cent. in 1927. The control of this Corporation was disposed of to an American company in 1926, but a large interest in it is still retained. A subsidiary American-controlled company in the State of Texas has yet to prove itself, but it has to its credit a well in Chittim County, Texas, sunk to a depth of 7,635 feet.

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[1] See Article " Oil-minded Albion," by Wallace E. Pratt, Geologist Humble Oil and Refining Co., Houston, Texas, *Mining and Metallurgy*, November, 1928.

This brief record may help the reader to see the business of oil-prospecting in its true perspective. If there are great prizes, there is much more than a proportionate number of blanks, and those who go into this business on the large scale must be prepared for an immense expenditure of capital which may easily be lost. Cowdray minimized his risk by spreading his operations over the widest area, but it was only by immense perseverance and the investment of a vast capital that he obtained his reward, after ten years of effort, in one field among the many tested.

CHAPTER XIX

ACTIVITIES IN WAR-TIME

The Firm in the War—Death of Geoffrey Pearson—Oil in War-time—The Tanker Service—Gretna Green—The Chateauroux Tank Factory—The Clyde-Forth Oil Pipe-line.

After the great oil adventure, Cowdray had slowed down the contracting side of his business, and in August, 1914, when the war broke out, the Firm had only two great contracts on hand, the Valparaiso Port Works for the Chilian Government, and the Royal Albert Dock Extension for the Port of London Authority. Both had to be suspended or delayed while Cowdray and his partners bent all their energies to war work.

A heavy blow fell on him at the very beginning, for his youngest son, Geoffrey, who had volunteered for service as a dispatch-rider, was killed in France on September 6, the first day of the Battle of the Marne. He had been sent to Paris on September 3, on a motor-cycle, carrying a companion in a side-car, to fetch letters and bring back spare parts for lorries. On his way back he lost his way and ran into a party of Uhlans near Coulommiers, and was taken prisoner with his companion. After three days in which they were roughly treated, and when on march placed in the front of the troops, they made their escape when their guards were attacked by the French, and managed to crawl five hundred yards away through long grass. Unhappily, they were followed by one of the guards, who fired at them four times, killing Geoffrey instantly. His companion, who was with him to the last moment, contrived to escape and came back with the story. Geoffrey was buried where he fell, not far from Meaux, and Lord Murray, who was in France at the time, found the spot and had it marked with a cross. Eight years later the body was re-buried in the British Cemetery at Montreuil, and Cowdray himself went to France, together with his sister-in-law, Mrs. Kinnell—Lady Cowdray being at that moment too ill to travel—to be present at the reburial. He afterwards erected a permanent memorial at Verredes to mark the place where his son had fallen. Geoffrey left a widow and one daughter aged three and a half years.

Of his other two sons, Harold, the eldest (now Viscount Cowdray), was Major in the Sussex Yeomanry and went out with them to Gallipoli as Second-in-Command, afterwards being detailed for Staff work, under General Sir Gerald Ellison and General Sir John Cowans. The other son, Clive, was seconded to help his father in the oil business, which had now become one of the chief sources of supply for the British Navy and its allies. A voluminous correspondence shows the care and pains which Cowdray gave to all ends of this business during the four years of the war. He watched the production in Mexico from week to week, giving advice and instructions by cable, and supervised the transport and distribution in close touch with the Admiralty, which requisitioned and directed the course of the seventeen vessels of the Eagle Oil Transport Company. Three were sunk, and five were torpedoed and repaired and sent to sea again. The fleet, with a total dead-weight tonnage of 215,000 tons, carried nearly three million tons of oil in the four years, the greater part of which was on Admiralty account. For months together it was a difficult and dangerous service, the tanker being a legitimate mark for the submarine, but in spite of hair-breadth escapes and many casualties, officers and crews faced it with unflinching steadiness, and earned the warmest approval from the Admiralty for their courage and skill.

The largest single operation undertaken by the Firm during the war was the general supervision of the works of the great munition town of Gretna. The purpose of this was to make good in the shortest time possible the lack of high explosives, which was so severe a handicap to the fighting army in the first eighteen months of the war. The Gretna factory was designed for the production of cordite up to an annual output of 40,000 tons. Not only had an immense plant to be installed, but accommodation had to be provided for the army of workers, men and women, who would have to be assembled to man the factory. In fact an entire new industrial town capable of accommodating from 15,000 to 20,000 workers had to be erected in a few months.

The site chosen was the famous border country partly in the county of Dumfriesshire and partly in the county of Cumberland, on the shores of the Solway Firth. It covered an area of fourteen square miles with a length of nine, and had the advantage of being remote from air-craft, and easily joined up with the principal railway systems at Carlisle, which was nine miles distant. The Ministry of Munitions started on it in August, 1915, with a multiplicity of contracts divided between competent and well-known building firms, but after three months it decided, in its own words, to " entrust the general supervision of all the constructional work to a first-rate engineering firm with long experience in the carrying out of the largest contracts," and it was afterwards able to say that " the rapid progress realized was due in large measure to the success with which this firm co-ordinated and systematized the work of the individual contractors."

The Pearson Firm took up the work of construction managers in October, 1915, and in eleven months they brought the factory to its producing stage, and in another nine months (June, 1917) to its total-production stage. The mechanical part of the work included a complete system of factory railways—in all 78 miles of standard gauge and 47 miles of 2-ft. gauge—connected with the main lines of communication, both for the transmission of labour and material within the factory, and for the reception of raw material and dispatch of the finished product ; a great central power-house with a capacity of 10,500 kw. ; electrical distribution throughout ; a water supply with pump-house and filters and reservoirs—all this in addition to the immense and intricate plant, the chemical laboratories and the storage needed for the production and handling of cordite. And then—and not least important—there was the human side of the problem, which was solved by the building of a new town which, by general consent, was clean, wholesome and sightly—in fact a model of what an industrial town might be, if it could start from the beginning on a clear site and be concentrated under one control on one product, for which there is an unceasing, unlimited and ever rising demand. It is part of the irony of things that only war appears to produce the conditions of the ideal industrial city.

By this time Cowdray had his hands more than full, and he was shortly to join the Government himself as President of the Air Board. He gave all the time and thought he could to the Gretna scheme and was available at all difficult moments, but he deputed the actual supervision to his brother, Mr. Edward (later Sir Edward) Pearson, whose indefatigable work in these years contributed not a little to the impairment of his health and his early death. With him in charge, the Firm put the whole of its organization and all the driving power it was capable of into the construction of the munition town, and succeeded in doing what by all peace-time standards would have been deemed impossible.

Though the supervision and the final responsibility, and the actual construction of a large part of the manufacturing plant rested on the Pearson Firm, the township of Gretna was the work of many hands. Mr. Raymond Unwin superintended its lay-out; Mr. C. M. Crickner, as resident architect, designed a large number of its buildings; other architects were brought in to design the churches of various denominations, and vied with each other in showing what admirable results might be achieved by the intelligent use of ordinary brick and plain white plaster. With the rapidly rising price of timber, the Government soon discovered that it was nearly as cheap to build in brick as in wood, indeed, since brick buildings would have a permanent value when the war ended and wooden structures practically none, in the long run probably cheaper. Thus, for the churches and the three hundred and fifty or so stone houses, hostels and clubs which were erected on the site, architects and designers were able to think of the future, and these buildings remained on the ground, when others had been cleared, to form the nucleus of a new residential area and garden city within easy reach of Carlisle.

Gretna, surrounded by its barbed wire fence, working day and night at its unending task of transforming cotton waste into cordite cords, with its bizarre combination of war and peace, its storage tanks, its mixing houses protected with mounds of earth, its scores of miles of steam and acid conduit pipes carried on their high trestles, its ether works draining the country of whisky and spirits ; its churches of all denominations on this scene of war, its shops, cinemas, institutes, hostels, bakeries, laundries—is now only a memory which some may not wish to recall. But while it lasted it left on the mind a powerful impression of human energy and skill, and among its peaceful triumphs may be recorded the fact of which the Firm was legitimately proud, that, thanks to the precautions taken, the total death-roll from accident was only seven, and of these three were due to falls.

Since the name of Edward Pearson is specially associated with the Gretna undertaking, a few words may fitly be said about him here. He worked all his life with S. Pearson & Son, and won a distinguished place among Cowdray's partners and colleagues. Being eighteen years the younger, he had served his apprenticeship to the Firm when his brother was already its head, and to an engaging modesty and simplicity of manner, he added not a little of his brother's thoroughness and resourcefulness. In the year 1918 he was sent to France with the local rank of Brigadier-General to report upon and organize the Labour battalions, but his main work during the war was at Gretna. In undertaking this, Cowdray stipulated that his brother should have a " free hand." This was at first resisted as an unheard-of condition in contracts with the Government, but it was so obvious that only one controlling will could pull this job together that Sir Clarendon Hyde succeeded in getting the words " shall have full control and discretion as to all matters connected with carrying out " the work embodied in the contract. Edward Pearson thoroughly justified the trust reposed in him. The regulating head, with power and capacity for speedy decision, for lack of which the work had stagnated, was now provided ; everything was dovetailed symmetrically, the necessary decisions were promptly made, and by September, 1916, the great factory and town was producing cordite, and from that time onwards produced in steadily increasing quantities, until in June, 1917, its total capacity was reached. Edward Pearson had the happy knack of exercising power without creating friction, and no great undertaking requiring such intricate co-ordination can ever have been carried through more smoothly. He was also, both before and after the war, entrusted with the direction of the great Port works of Valparaiso, for which he himself obtained two contracts, one in 1912 and the other in 1923, amounting in all to over £4,000,000,

The King and Queen paid a special visit to Gretna in 1917, and Edward Pearson received the honour of knighthood, which he well deserved. He and his wife exercised much hospitality at their home at Brickendonbury, Hertford, and interested themselves greatly in local affairs. He was twice mayor, and both he and Lady Pearson were given the rare distinction of the Freedom of the Borough, in recognition of their many services. But the strain of these years was greater than he could bear, and he died suddenly of heart failure on November 19, 1925, at the early age of fifty-one.

The Firm also undertook the submarine defences at the entrances of Dover Harbour and at the mouths of the Thames and Humber, placing their direction in the hands of Sir Ernest Moir, and in 1918 were entrusted with the erection of the Tank Assembling Factory at Chateauroux in France on behalf of the Anglo-American Commission. The British and United States Governments had agreed to erect this factory at their joint costs, and it was to be of a capacity to turn out a maximum of 1,500 tanks per month, of which the parts were to be sent out from England (and the United States). The figure is a hint of the scale on which tank-warfare was being prepared in case the German resistance should be prolonged. Cowdray undertook it at cost price, and Sir Frederick Hopkinson, who was given a completely free hand, took charge on the spot. On paper the erection of a seven-bay factory was no great affair, but to keep steadily at work in a war area through endless difficulties of transport, labour and material was no mean feat. Six different nationalities with nearly as many languages were on the ground, and all had to be hutted and fed, and persuaded to work together as one team. The labour was mainly Chinese and Colonial, and not always easy to handle. The material was always going astray, and some of it could never be traced. The war ended before the factory was finished, but both British and Americans were agreed that Sir Frederick Hopkinson had done extremely well in carrying the work so far in the time, and his tact and patience in handling a difficult job were justly praised.

Among other war-time projects was the idea of transporting oil from the West to the East coast of Scotland by means of a pipe-line from the Clyde to the Forth. This originated with Mr. John S. Smith, an engineer in the employ of the Pearson Firm, and was put forward by that Firm to the Admiralty on May 24, 1916. The reasons were the saving of the hazardous journey round the North of Scotland for tankers during the war period, also the saving of tonnage, time and money. Preliminary estimates of cost for both an 8-in. and a 6-in. line, to be completed in four months, were sent to the Admiralty in May, 1917, and further representations as to the advisability of the line made in July, 1917.

After a conference at the Admiralty in August, 1917, the line, tank farm and terminals were surveyed, and the details met with the approval of the Admiralty at the end of the same month. Nothing further was heard until October 20, 1917, when the Admiralty advised Messrs. S. Pearson & Son Limited that it had been decided to abandon the scheme. Notwithstanding this, an oil pipe-line was formally opened on November 18, 1918 (too late for war purposes), the Press reporting that " the scheme owes its inception to the enterprise and foresight of the British Petroleum Executive, who have co-operated with the Admiralty and carried the scheme through with the assistance of the United States." Observing this report, Cowdray wrote to the Admiralty in December, 1918, pointing out that Mr. Smith was the originator of the scheme.

The story of Cowdray's period in office as President of the Air Board will be dealt with in another chapter. Enough has been said here to show that his contribution and that of his Firm to the resources of the country in the years of the war was of high value. He and his Firm had built Dover

Harbour; opened up the Mexican oil supply, and furnished the transport which made it available for the Fleet; provided some of the principal anti-submarine defences, and borne the chief part in the construction of the greatest of the munition factories. Few individuals can have contributed more in their life-time to the sum of things which make up the resources of a nation when its strength is put to the test.

CHAPTER XX

PRESIDENT OF THE AIR BOARD

Joining the Government—An " Anomalous and Difficult " Position—Reconstructing the Board—One Board and Three Departments—Four Demands—Insufficiency of Supply—Air-raids and Public Opinion—The Need of one Responsible Authority—Cowdray and the Cabinet—Constituting the Air Ministry—Lord Northcliffe's Letter to *The Times*—Cowdray's Answer—The Prime Minister's Explanation—Withdrawal from the Air Board.

At the beginning of the year 1917 Cowdray received a step in the peerage and was created a Viscount, with the title of Viscount Cowdray of Cowdray, and shortly afterwards the new Prime Minister, Mr. Lloyd George, invited him to become President of the Air Board. Though he was already carrying heavy burdens which could not be shifted on to other shoulders, he felt the challenge of the occasion, and at once decided to accept. By so doing he became a member of the Government, and was sworn a Privy Councillor. He was warned from the beginning that the Presidency of the Air Board would be no sinecure. " I suppose I may say," wrote Lord Curzon in a letter congratulating him on his appointment, " that the Air Board is for the most part my child, and I am glad to hand it over, at a time when it has reached adolescence and is destined to live, to so experienced and competent a Chief." Lord Curzon proposed that they should meet, as they no doubt did, that he might explain the " history of the case, which is strange, and the position, which is anomalous and difficult."

To straighten out the position and prepare a scheme or charter under which the Air Board would have a measure of authority and definite duties assigned to it, was Cowdray's first task, and, though he was hampered by an attack of illness, he completed it during the first three weeks. The Air Board, according to his proposal, which was accepted by the Government, was to consist of five members—the President, a Parliamentary Secretary, the fifth Sea Lord, representing the Admiralty, the Director-General of Military Aeronautics (Lieut.-General Sir David Henderson), representing the War Office, and a representative of the Ministry of Munitions—and the President was to have the power of appointing three additional members, of whom Brig.-General Sir Sefton Brancker, now Air Vice-Marshal, was one. The Board was to be " free to discuss matters of policy in relation to the air and to make recommendations," but in this sphere it was to be only advisory and consultative. The Admiralty and the War Office were to " concert their respective aerial policies in consultation with the Air Board." They were to " formulate programmes of aerial production required for the fulfilment of approved policy," and the Board was then to say " how far it was possible to approve these departmental programmes, having regard to the possible rate of production," subject to an appeal to the Cabinet by any of the parties. The Air Board was thus a broker between Army and Navy, and in consultation with them was responsible for the designs of aeroplanes and sea-planes and their allocation between the two Services. But it was not responsible for production. This by a Cabinet decision of the previous December had been placed in the hands of the Ministry of Munitions, to which fell " the production of aircraft, their inspection during manufacture and the handing over of them to the Services for which they were destined."

Thus, though there was one Air Board, there were three Departments—Admiralty, War Office and Ministry of Munitions—whose co-operation was needed for anything that could be called an air policy. Cowdray was well aware of the inadequacy of this scheme for any permanent purpose, but he believed it to be impossible to reach any final settlement of the respective claims and points of view of Army and Navy in the middle of the war, and contented himself with what he hoped would be a sufficient working arrangement for the immediate emergency.

Sir Sefton Brancker recalls that at the first meeting of the Board, he asked Cowdray what he should do if a certain situation arose. The reply was " You will obey orders, General." "This, adds Sir Sefton, "was just what we wanted—a Chief who would give orders and see that they were carried out."

Thanks largely to Cowdray's good sense and amicable disposition, these arrangements worked better than might have been expected. The fact that all the Departments connected with the Board, including the representatives of the Ministry of Munitions and the military and naval Air executives, were from the beginning of January housed under one roof in the Hotel Cecil greatly contributed to smooth working. Both supply and design were now under the hand of the Air Board, and the military and naval representatives were brought into closer and more cordial relations. But there were inherent weaknesses in this provisional scheme which became apparent before many weeks.

There were four demands which had to be met before the air-position could be considered satisfactory: that of the fighting Army on its many fronts; that of the Navy which required all manner of aircraft for many purposes, but especially at this time to help it in its campaign against submarines; that of the defence against air-raids, which in the year 1917 seemed to be a serious menace; and finally for long-distance raiders to inflict reprisals on the enemy for his raids. How to satisfy all these demands with any production that could be expected in the early months of the year 1917 with the labour that the Government was willing to assign to it, or, failing that, how to ration an inadequate supply between claimants all of whom had reasonable and urgent demands, were problems which even the wisest and fairest of men could not be expected to solve to the satisfaction of all the parties and the public.

The fighting Army needed an always increasing number of machines, for scouting, for the direction of artillery, for bombing enemy positions, attacking enemy aircraft, and finally for ground fighting; and if it was kept short of these, it could reasonably say that its efficiency was impaired and that lives were being unnecessarily sacrificed. The Navy needed both airships and seaplanes for its anti-submarine patrols, as well as for ordinary scouting purposes, and could reasonably say that, if they were not forthcoming, the country would be in danger of starvation. The wastage was terrible, and at the best there was an inevitable pull between the two Services for the available supply, and the claim of the civilian for defence against air-raids had no special champion among the Professionals who represented the Departments. That the civilian must wait and take stoically the small share of the losses and horrors of war that fell to him until the much more urgent needs of the fighting forces were met, was a doctrine which military experts and a few newspapers constantly preached, but there was no question that the bombing of London and other centres and the appearance of impotence in face of attack were producing an effect with which the Government had seriously to reckon. The needs of the fighting front were veiled by the censorship, but the raids on English cities made a resounding noise, and the public more and more wanted to know what the Government and the Air Board were doing or proposed to do.

The answer during the first six months of 1917 was that for the moment almost nothing could be done, and it was the more disappointing to the public because the heavy punishment inflicted on airships in the previous year had led it to think itself secure. But so far from abandoning the air when the Zeppelins failed, the Germans had set to work to form a squadron of bombing aeroplanes to renew the attack in what they believed would be a more concentrated and deadly form. There was a pause while these preparations were being completed, but on May 16, 1917, they launched a squadron of sixteen aeroplanes, which, though it failed to find its way to London, did fearful havoc at Shorncliffe and Folkestone; and within the next few weeks other powerful squadrons reached London in broad daylight, and inflicted heavy casualties and damage in and about Liverpool Street and the City (June 13 and July 7). Other serious raids in different parts of the country took place about the same time, and there was no escaping the fact that the defence had proved quite unequal to these attacks. The evident defencelessness of London caused considerable agitation, and by no means least in the House of Commons. On July 7, Cowdray was asked to explain the situation to a Committee of members presided over by Mr. William Joynson-Hicks (now Lord Brentford) and he spoke with a frankness which seems only to have increased their concern. The next day they sent him the following resolution :

> This Committee having considered the President of the Air Board's statement as to the number of persons employed in the aircraft industry, is of opinion that it is gravely insufficient to carry out an adequate offensive programme for next spring. It accordingly urges the Government to transfer at least 100 per cent. additional labour from other forms of work not at the moment so important as the production of air-engines.

Mr. Joynson-Hicks was somewhat apologetic in forwarding this resolution, and explained that the M.P.s had acted under a temporary irritation which should not be taken as reflecting on the President of the Air Board. Cowdray at that moment was very unlikely to take it so, and, like other Ministers in similar position, probably welcomed any outside aid in pressing the Cabinet to allot a larger quantity of labour to his department.

But by this time he was even more concerned about the organization of the Air Force than about the supply of aircraft, which he saw going ahead with fair rapidity. His six months' experience had convinced him that the defence of England against attack from the air could not be left to a residuum of ill-organized effort, after the needs of the Army and Navy had been supplied. Some authority, he was now clear, had to be made responsible for it and given the power to requisition the necessary machines and personnel on at least equal terms with the other fighting services. It was therefore a relief to him when, on July 11, the Cabinet, which also was becoming alarmed, deputed the Prime Minister and General Smuts to go into the whole question of Home Defence against aerial raids, with a view to determining its organization and direction. Cowdray was in close consultation with General Smuts during the next few weeks and warmly approved the recommendation which the

Prime Minister and the General made to the Cabinet on August 19, that an "independent" Air Board should be set up, i.e. a Board with its own expert staff and in a position to make its own requisitions for Home Defence.

This was accepted "in principle" on August 24, and in the meantime progress had been made with a scheme whereby the defences of London were constituted a separate command under the War Office, embracing "all the means of defence by air and on the ground." For a time there seemed to be some improvement in the defences, and the enemy was reported to have suffered heavier casualties. But once more he changed his tactics and took to night-raids by moonlight which presented new problems that again baffled the defence. Barrage fire and many ingenious devices such as the "balloon aprons" were tried, but it was impossible in the short time to produce a sufficiency of the right kind of machines to challenge the raiders, or to train a sufficient number of pilots in night flying. In the light of subsequent experience it is doubtful whether any efforts could have enabled the defence to equal the attack had the enemy been able to sustain it and reinforce it—as, fortunately, he was not—and it is perhaps more a matter for surprise that the raids did comparatively so little damage than that the defence failed to prevent them.

Cowdray's own thoughts were more and more turning to "reprisals" as the proper deterrent. He saw the supply of aircraft coming up to the point when all probable needs of both Army and Navy would be met and an increasing surplus be available for attacks on the enemy. But he was more than ever convinced that the Air Board, as constituted, would be a very unsuitable body to decide on the proper use of this surplus or to arbitrate between the claims which both Army and Navy would certainly make on it; and thus thinking, he pressed harder than ever for the independent Air Ministry, and when for nearly a month after its acceptance "in principle" by the Cabinet nothing more was heard of it, he grew impatient. Undoubtedly there were difficulties. It was one thing to agree to the principle and another to override the objections in detail of Army and Navy, both of whom saw themselves threatened by an independent third Department. But both he and General Smuts were clear that a settlement was urgent, and he warmly approved when, on September 18, the General presented a memorandum to the Cabinet urgently pressing for action.

There were lively moments in the argument which followed, and Cowdray was reproached with turning his back on his own scheme, the scheme which he had produced at the beginning of the year. To this he answered frankly that he had been converted by experience, and was now a " whole-hogger " for the independent Air Board or Ministry. " When London is half levelled," he told the Cabinet, " someone will have to be lynched, presumably the Cabinet since no one else has any clear responsibility. Hence I do not personally desire the job, but someone must face the music and step into the breach."

By the middle of October the question was definitely settled, and Cowdray now set to work to prepare the Bill for the constitution of the independent Air Ministry, which was passed through Parliament in the last weeks of November. Though comparatively simple in its proposals, that Bill embodied the work of a large number of expert Committees—no less than thirteen, Cowdray told the House of Lords—and it required all his skill and tact to produce it in any agreed form. Briefly it created an Air Council (to be presided over by a Secretary of State), an Air Staff, and an Air Force ; and it provided for the transfer of men serving with either Army or Navy to the new Force, and applied Army discipline to that Force. It left many things open to be decided by experience, for at that moment it would have been impossible and inadvisable to lay down hard and fast boundaries for the three services, but it definitely constituted the Air Force as a separate service under the Crown, and is the Charter on which that Service has been built up since the war. Lord Crawford, to whom it fell to introduce the Bill into the House of Lords, said truly, " it marks a notable stage in the progress and evolution of our Air Service—which progress, I believe, has been made possible only by the power of organization, by the experience in handling big things, and by the knowledge of men possessed by Lord Cowdray." (November 21, 1917.)

But though he had got his Bill and seen his independent

Air Force with its Ministry set up, Cowdray was not destined to be the first Secretary of State for the Air, as he had supposed to be understood between him and the Prime Minister when he undertook the work of reconstruction. On the morning of November 16, when he picked up his *Times*, he found printed in it a letter from Lord Northcliffe to the Prime Minister:

> 15th November, 1917.
>
> DEAR PRIME MINISTER,
>
> I have given anxious consideration to your repeated invitation that I should take charge of the new Air Ministry. The reasons which have impelled me to decline that great honour and responsibility are in no way concerned with the office which is rightly to be set up. They are roughly as follows:
>
> Returning after five months spent in the virile atmosphere of the United States and Canada, I find that, while those two countries are proceeding with their war preparations with a fervour and enthusiasm little understood on this side of the Atlantic; while the United States has instantly put into operation Conscription, over which we wobbled for two years, and is making short work with sedition-mongers; while Canada has already given such proofs of thoroughness as the disfranchisement of conscientious objectors and the denaturalization of all enemy aliens who have been naturalized in the last fifteen years; while we for our part are asking immense sacrifices from those peoples—there are still in office here those who dally with such urgent questions as that of the unity of war control, the eradication of sedition, the mobilization of the whole man and woman power of the country, and the introduction of compulsory food rations. I have had personal experience myself, while in America, of the obstruction and delay in certain Departments in London which, for example, postponed the sending of Lord Reading's vital and most successful Mission. I find that the Censorship is still being misused, and that men in various positions of authority, who

should have been punished, have been retained and in some cases elevated. The spirit of the men and women of Great Britain is clearly as eager and as splendid as ever. We have, in my belief, the most efficient Army in the world, led by one of the greatest generals, and I am well aware of the fine achievements of many others of our soldiers, sailors and statesmen; but I feel that in present circumstances I can do better work if I maintain my independence and am not gagged by a loyalty that I do not feel towards the whole of your Administration.

I take this opportunity of thanking you and the War Cabinet for the handsome message of praise sent to me as representing the five hundred officials of the British War Mission in the United States, many of them volunteer exiles. Their achievements and those of their ten thousand assistants deserve to be better known by their countrymen. The fact that their work is not known is due to the absurd secrecy about the war which is still prevalent. Everything that these officials are doing is known to our American friends, and of course to the Germans. I trust I make no breach of confidence in saying that some of the documents which have passed through my hands as Head of the Mission are such as if published would greatly increase our prestige in the United States and hearten our people at home.

May I also take this opportunity of giving a warning about our relations with that great people from whom I have come? We have had the tragedy of Russia, due partly to lack of Allied propaganda to counteract that of the Germans. We have had the tragedy of Italy, largely due to that same enemy propaganda. We have had the tragedies of Serbia, Rumania and Montenegro. There is one tragedy which I am sure we shall not have, and that is the tragedy of the United States. But from countless conversations with leading Americans, I know that unless there is swift improvement in our methods here, the United States will rightly take into its own hands the entire management of a great part of the war. It will not sacrifice its blood and treasure to incompetent handling of affairs in Europe.

In saying all this, which is very much on my mind, believe me that I have none but the most friendly feelings towards yourself, and that I am greatly honoured by your suggestion.

Yours sincerely,
(Signed) NORTHCLIFFE.

Cowdray thus learnt for the first time that the Prime Minister had offered the Presidency of the new Air Ministry to Lord Northcliffe. How completely he was taken by surprise may be judged from the fact that he himself had only on the previous day (November 15) written to Lord Northcliffe, who was just back from his War Mission to the United States, suggesting that they should meet " to receive and give the latest information about aeroplane supplies " in this country and in America. The correspondence which followed may be left to speak for itself :

16 Carlton House Terrace,
S.W.
Nov. 16th, 1917.

DEAR PRIME MINISTER,

It ought not to have been left to me to receive from Lord Northcliffe's letter to *The Times* the first intimation that you desire a change at the Air Ministry, and I think in consequence you cannot be surprised to receive my resignation. I hope it will be accepted with as little delay as possible so that the work of the Department may not unduly suffer during the transfer of my duties to my successor.

When you honoured me in January last by requesting that I should take up the position which I am now resigning, you explained that it was intended that the status of the new Air Ministry then to be formed would be equal to that of the Board of Admiralty and the War Office; that I should find difficulties in co-ordinating the Royal Flying Corps and the Royal Naval

Air Service; that the problem of increasing the supply of aircraft demanded immediate attention; and that it was left to me to report to the Cabinet what the definite duties and responsibilities of the new Ministry should be.

After full consideration of the situation I was able, within four weeks of my appointment, to submit for the approval of the Cabinet the terms of a Charter agreed upon by the Navy and the Army and the Ministry of Munitions. I had come to the conclusion that the best course to follow in creating an Air Ministry with full control of the Air Forces was to proceed by stages, the first stage being represented by the Charter, whilst the final stage is represented by the Air Force Bill now being discussed by the House of Commons. When this Bill becomes operative the nation will possess an Air Service with full powers—the desideratum expected, and, in fact, demanded, by the country.

As for the material results of the year, the devoted work of my colleagues and staff of the Air Board together with the loyal co-operation of the Departments concerned have enabled the effective Air Forces of the Army to be increased threefold.

Yours sincerely,
(Signed) Cowdray.

The Right Hon. D. Lloyd George, M.P.,
10 Downing Street, S.W.

" No one," said the Prime Minister in his reply, " regrets more than I do the publication of Lord Northcliffe's letter and I read it with great amazement for the first time in this morning's papers. Under the circumstances I am not surprised that you have taken the step of tendering your resignation as you have distinctly a right to complain." The Prime Minister went on to say that he had " more than once publicly recognised the invaluable services " which Cowdray had " rendered to the country by his tactful administration of the Air Board." " During your period of office the production of aeroplanes has increased enormously, and my decision to effect a change when the new Air Ministry received legislative sanction was attributable not to any disappointment with your activities, but rather to a desire to secure at the head of the Board the services of one who was personally acquainted with the organisation of the Air Service in America and who was therefore in a better position to co-ordinate the energies of the two countries." In conclusion the Prime Minister asked him to remain in office until the Bill constituting the Air Ministry had become law.

In a brief rejoinder Cowdray declined this proposal on the ground that it would " merely prolong the natural unrest at the Ministry and also that it would weaken my protest." " Further," he said, " I have to admit that my many years of intimate knowledge of America and of the present position do not permit me to concur in your expressed reason for the desired change, viz., that Lord Northcliffe's personal knowledge of the Air Service in America would have enabled him better to co-ordinate the energies of the two countries."

The regrets of the Prime Minister at the unconventional manner in which his plan had been revealed could scarcely be a consolation to Cowdray, and it would be idle to pretend that he did not feel deeply hurt at the manner in which he had been treated after his efforts at the Air Board and the part he had played in constructing the new Ministry. He had brought all his mechanical and organizing ability to bear on a situation in which the main deficiency was the lack of aircraft, and had raised the output of machines from the 2000 per quarter at which it had stood when he came into office to over 5000 per quarter before he left, with a high probability that this figure would be largely and rapidly increased in the following months. When experts differed, he had brought a skilled judgment to bear on the choice of types and set his face against the delays which resulted from hesitation between the types. Where power failed he had used suasion to reconcile the claims of the fighting services, and in all these difficult and controversial matters he had so handled his Board that the representatives of Army and Navy on it had never once found it necessary to use their right of appeal against his decisions. At the same time, he had laid the foundations of a permanent Air Force and contrived to harmonize a great variety of conflicting opinions in what was to all intents and purposes an agreed measure. There could scarcely have been a better administrative record for so short a time, and it was naturally painful to him that it should be so little recognized by the Head of the Government.

Letters expressing indignation and sympathy poured in on him, but the times were too grave for personal recrimination, and he added nothing to what he had written to the Prime Minister. When the Bill constituting the Ministry of Air—his own child—was presented to the House of Lords a fortnight later he supported it warmly in a brief speech which contained no word about his own part in it or his personal position. And when Lord Rothermere, who did not share his brother's objections to joining the Government, was appointed as Air Minister, he wrote to him at once offering to place his knowledge and experience at his disposal. The rest was silence, but the warm tributes which came to him from his colleagues on the Air Board and officials in the Department were a special satisfaction to him.

CHAPTER XXI

COAL AND NEWSPAPERS

Kent Coal—Partnership with Dorman, Long & Company—A Far-reaching Scheme—Newspaper Enterprises—The *Westminster Gazette*—Conversion to a Morning Paper—A Difference of Opinion—An Erratic Business—Reconstruction of the Firm of S. Pearson & Son.

If any man had reasonable excuse for resting and being thankful it was Cowdray at the end of the war. He had great estates in England and in Scotland; he had come successfully out of the most anxious and difficult of all his undertakings; he had sons to follow him in his business; he was head of a great organization with interests and properties in all parts of the world. Merely to conserve and administer what he and his family and his Firm now possessed might have taxed the energy of any ordinary man. But at the age of sixty-two he was still in his own thoughts a young man, and the end of the year 1918 found him, as usual, planning far into the future.

Among other things, he had long been turning over in his mind the possibilities of coal in Kent. No one hitherto had made a success of it, but there was no doubt that the coal was there in large and, as he believed, paying quantities; and the probabilities were that if it had not paid, it was for lack of proper organization and management. There was iron ore in abundance on the spot, and if the coal and iron could be joined up in one enterprise, a great, new and profitable industry might be established. These were not random thoughts; from the days of the Dover Harbour contract onwards he had been over the ground, and he seriously believed, and, in spite of all the troubles in the coal-trade in the subsequent years, continued to believe, that there was a great industrial future for the county of Kent.

The idea took shape in the form of a partnership between Messrs. Dorman, Long & Co., Limited, who already had large interests in Kent Coal, and the Whitehall Securities Corporation, Limited, representing Cowdray and his family. A combination with a firm of the highest reputation in iron and steel was, in Cowdray's view, essential to success, and he found it in this partnership. The scheme was laid out from the beginning with great thoroughness, and its principal features are summarized in a memorandum which he wrote in May, 1922:

> Messrs. Dorman, Long & Co. and the Whitehall Securities Corporation have entered into an equal partnership for the purpose of creating a great coal, iron and steel industry in Kent, and that such undertaking or undertakings shall be at least as completely self-contained as Messrs. Dorman, Long's own existing business is, or as any other company in the same business may be, such as, for example, the Consett Iron Co.
>
> The broad idea is that the partnership, when its undertakings are finally developed, shall consist, *inter alia*, of the following branches:
>
> 1. The ownership or control of collieries producing 4,500,000 tons of coal per annum if sufficient coal areas can be obtained by purchase or under lease on reasonable terms to produce that output for a period of, say, 75 years.
> 2. The requisite coke works with their by-products, plants, chalk quarries, brickworks, etc.
> 3. Blast furnaces for an output of 500,000 tons of pig iron or its equivalent per annum.
> 4. Steel works and mills for rolling plates and sections of a capacity that will take and turn out as finished products the iron produced by the blast furnace.
> 5. Such railways, rolling stock, wagon constructing and repairing shops as may be needed.
> 6. Such foundry or foundries as are required for the purposes of their own company and for absorbing and turning into marketable castings such of their surplus pig iron as can be most profitably turned into saleable

> products. For instance, Kent might produce cast-iron pipes and a lot of the cast-iron building fittings used by London and the surrounding country. Also the segments for the Channel Tunnel and the underground railways could be turned out in Kent as well as anywhere.
>
> The partnership should be in a position to take contracts if necessary for the erection of part of the structural steel that it produces.
>
> 7. An interest in or the ownership of such foreign iron ore companies as may be thought desirable with a view to supplying their own ore required for mixing with Kent ore.
>
> 8. The housing of the work-people and employees of the company and the amenities required in connexion with the various villages and townships.
>
> 9. The construction or interest in a shipping port or ports and also in shipping.

The whole of the share capital (£3,050,000) was owned in equal shares by Dorman, Long & Co. and the Whitehall Securities Corporation, and four years later there was an issue to the public of £2,000,000 five per cent. debentures, guaranteed as to principal and interest by the Government under the provisions of the Trade Facilities Act. It was one of the conditions of this issue that the whole of the profits up to the end of 1930 should go to the development of the industry and that no dividends should be paid upon share capital.

The principal properties of the Combination were the Betteshanger Colliery near Deal, planned for an output of 750,000 tons per annum, the Snowdown Colliery adjoining the main line of the Southern Railway between Canterbury and Dover, planned for 500,000 tons per annum, and other mineral and surface rights in East Kent sufficient for the establishment of six more collieries. The far-reaching plans of the Combination raised many apprehensions as to the fate of this beautiful gate of England and the possibility of its being converted into a southern Black Country. But Cowdray and his partners were determined that the country should not be defaced, and from the beginning sought the best advice in housing, planning and the disposition of their plant. Their hope was to demonstrate in Kent that a great industry could be established and carried on without polluting the streams, destroying the landscape, or darkening the sky of the region in which it was situated. If Kent possessed the mineral wealth which they believed it to have, it seemed to them certain that it would not long remain unexploited, and in that case the only question was whether the exploiters would respect the amenities of the surrounding country.

The hopes of the promoters, as well as the fears of those who plead for an " unspoilt Kent," have been held in suspense by the subsequent course of the coal-trade, and Cowdray did not live to see the enterprise come within sight of the expected profit-yielding period. That remains for others, but he lived through the year of trouble, 1926, and regarded it with his usual philosophy as a period of temporary affliction from which the coal-trade would emerge in due time and renew its prosperity. It is worth noting that he put into Kent coal exactly the amount of capital (£1,500,000) that twenty years earlier he had declared to be the limit of his investment in oil in Mexico, and it is a reasonable surmise that the determination not to be beaten which carried him through his oil venture would have steeled him against the adversities of the coal trade.

In the same years he found himself deeply involved in the owning and running of newspapers, which for men brought up in other lines of business is perhaps the most tempting, speculative and dangerous of all enterprises. He had dabbled in it early in his career to the extent of owning a weekly paper, originally the *Weekly Sun*, with Mr. T. P. O'Connor as editor, and afterwards the *Sunday Sun*, with his friend Dr. Mackew as editor. But in those days he had other things to do, and the developments of Sunday and weekly journalism rendered it useless to persist in that comparatively small venture. The beginning of his more important enterprises was in 1908, when he became one of a syndicate of ten which acquired the evening *Westminster Gazette* from Sir George Newnes, its founder and original proprietor.

I have told the story of the *Westminster Gazette* in another book, but something may be said here about Cowdray's special part in it. Although in the early years he did not take an active part in its management, he was always interested and always ready to help. In common with all the proprietors, he held the view that the purpose of the paper was first of all to be an organ of opinion expounding the Liberal view, and only after that, if at all, to earn dividends for its proprietors; and so far from complaining, he abounded in encouragement and consolation to the editor, when the latter was depressed by the profit and loss accounts. But the war changed the whole basis of newspaper costs, and in the subsequent two years the loss, which in the years before the war had ranged between £10,000 and £14,000 a year, ran up to twice that figure and threatened to go even higher. By that time he was bearing the chief part of the loss, and if the paper was to go on, he must in a short time have borne the whole of it. Meanwhile in 1918 he had deputed his son, the present Lord Cowdray, to represent him on the Board.

In the circumstances as they were at the end of the war, the editor and staff could have had no grievance if he had declared himself unable to go on. But this was not at all what he had in mind. His idea was, characteristically, to do something bigger and better, which, in the end, would put the paper on a firm commercial basis, and leave it established as a going concern when he passed from the scene. He asked me whether I thought that the *Westminster* could, without changing its character as a serious newspaper of opinion, be made profitable in the London evening field, and I replied that on the then basis of costs, and with two or three others of the same type in competition, it could not. (I did not foresee that, if it had persisted, it would in a short time have had its own part of the field to itself.) "Very well," was the answer, "I want to go out into the bigger field of the morning newspaper, and am prepared for a much larger expenditure if I see a reasonable chance of return in the end."

It was the natural conclusion of an enterprising and public-spirited man, and he did not seem to be at all discouraged when I said that at least a million of money would be required for the starting of a new morning paper. By this time he had acquired a large interest in a group of provincial papers, and had been greatly struck by the ability and success with which they were conducted by their Managing Director, Sir Charles Starmer. He therefore proposed that Sir Charles should be responsible for the business side and general management of the new paper, while I remained editor and political director. Some such division of labour would in any case have been necessary, and I felt no difficulty in consenting to it.

But at this point a difference of opinion developed between us. I was thinking mainly of the type of morning paper which would best preserve the identity of the evening *Westminster ;* he was advised that there would be little demand for this type in the morning field, and that the cost of producing it would be prohibitive. It was more than possible that this advice was sound, but it raised a serious doubt in my mind whether, with my experience and bias, I should be the right editor for the new paper, or whether it could retain the readers of the old *Westminster*. In any case I feared a divided mind which might be fatal to success on either the new or the old lines, and said quite frankly what I thought. This undoubtedly placed him in a difficulty. Having made up his mind, he had pushed matters through with characteristic energy, and now at the eleventh hour he found himself faced with a conflict of opinion about the specification and design of the new venture.

He behaved with great considerateness in the rather difficult circumstances, entering with the utmost fairness into my point of view, but saying frankly that he was committed beyond retreat. Finally, he proposed that I should take time to consider the matter, and that in order to avoid the division of opinion which I foresaw, I should accept a commission to attend the Washington Naval Armament Conference on behalf of the new paper, and leave the field clear for the experiment to be made in my absence. Then on my return I could decide at my leisure what I would do. This seemed to me a fair proposal, and I unhesitatingly fell in with it.

On my return I decided that I could not make the radical change in my methods and way of life that editing a morning paper would require, and I also felt that I should not be a good editor of the type now fixed. I therefore told him that I could best serve the paper by remaining a writer for it, but not accepting the editorship. For some time he resisted this conclusion and begged me to reconsider it, but he told me in after days that he thought I had done rightly. At all events, this incident never in the least disturbed our cordial relations, and for the five years of the separate existence of the morning *Westminster* I remained a constant contributor and always on the most amicable footing with its editor, directors and staff.

Since he incurred a good deal of unfounded criticism on the assumption that he had treated me badly, and found himself classed with proprietors who were supposed to have behaved ungratefully to Liberal editors, this statement of the circumstances ought, I think, to find a place in his biography. I had no grievance whatever, but on the contrary the best reasons for being grateful to him. But for his generous support the evening *Westminster* could not have existed for so long as it did, and there would have been no thought of a morning paper. Had his purpose been a merely commercial one, he would have been content with drawing the profits of the successful provincial papers which were largely his property, instead of embarking on what at best was bound to be a costly and highly speculative enterprise. To the end he was strong on the point that serious politics should not be sacrificed to commercial exigencies in the morning *Westminster*. What he would have done if he had lived longer can only be a matter of conjecture, but he regarded an amalgamation in one direction or another of London Liberal morning newspapers as a desirable object, and his successors were not departing from his intentions or abandoning the newspaper field when they decided to join forces with the *Daily News*. Both in London and the Provinces they retain large and important interests with many opportunities for expansion and development.

In dealing with newspapers as with other parts of his business, Cowdray kept an even temper through the most unexpected developments. His letters on the subject were always good-humoured even when money was pouring out in streams of alarming volume, but the journalist detects in them a certain surprise at the seemingly erratic course of events. He who had been accustomed to precise specifications—estimates, forecasts, measurements of quantities—which nearly always proved accurate, or at least within the expected margin of safety, finds now that nearly every forecast is defeated by something which no one could have been expected to foresee. The careful statement laid before him to show that a projected newspaper could be made self-supporting by expenditure of a certain sum of money overlooked the fact that new methods were coming into vogue which would require him either to abandon the project or quadruple the expenditure. The quite rational logic which seemed to prove that if circulation increased, advertisements would increase in the same ratio ; the seemingly well-justified calculation which showed that equilibrium would be reached and a little later handsome profits earned after a calculable period of diminishing losses ; the promise of economies in this or that department, and the assumption that expenditure would remain constant in other departments—all these methods of regulating and controlling the course of events, so well justified in the businesses with which he was familiar, proved very slippery ground when it came to newspapers. Fashions changed, expenses increased in altogether unexpected ways ; neither advertising nor circulation seemed to obey any ascertainable law. " The innovation," as he remarks a little ruefully at one moment, " upsets all calculations, and we have either to disappear or go with the tide." Disappearing was never to his liking, and it is quite probable that, if he had been a younger man, he would have bent himself to the newspaper business with the same energy and whole-heartedness that he brought to his other occupations.

During the same years he carried through the reconstruction of his Firm to enable it to deal with the vast and varied interests which by this time had thrown the contracting part of the business into the background. As already recorded, it had been converted into a limited liability company in 1897, and in 1907 the Whitehall Securities Corporation was formed to take over its various interests outside contracting. In

1919 S. Pearson & Son (Contracting Department) Limited was constituted and took over the active administration of all the Firm's contracting interests, and S. Pearson & Son thereupon became a holding company. In the same years the Whitehall Petroleum Corporation Limited was formed to take over the oil interests outside Mexico, and Whitehall Trust Limited constituted as a finance and issuing house owned by the Firm, with Mr. John Tanner as Managing Director. About the same time the Firm acquired an equal interest with the French House of Lazard Frères in the London House of Lazard Brothers & Co., and Sir Robert Kindersley is chairman both of Whitehall Trust and Lazard Brothers.

Three years later (1922) the Whitehall Electric Investments Limited was formed to take charge of the various electric light, power and tramway interests of the Firm in Mexico and Chile. In the meantime, the one and only public issue by the Parent Firm (£500,000 debentures issued in 1901) or such part of it as had not been liquidated by the sinking fund, had been paid off and all the properties were now owned by Cowdray, his family and partners, who between them supplied the directorates of the various companies and corporations. The organization may seem complicated, but it followed logically from the structure of the business, and was in accordance with Cowdray's principle that each separate enterprise should stand on its own feet and account clearly for its own profits and losses.

Cowdray was always on the look-out for promising young men to bring into his Firm but he required that even the cleverest should be carefully trained. How carefully may be judged from the course that he laid down for the son of an old friend, upon whom his eye fell as a desirable recruit. He was to serve a six years apprenticeship, a year to begin with in foreign travel in France, Germany and "the countries of the East including Turkey"; and after that five years with a first-class Firm of Stockbrokers. Cowdray made a handsome contribution to the year of travel and after that guaranteed him a good income in addition to any remuneration he might be receiving from the Firm of Stockbrokers, but not till the six years of apprenticeship were ended was he to take up the position intended for him with the

Pearson Firm. All through Cowdray took the deepest interest in this young man's training, saw him every six months, advised him at every point, and on the last day of his life discussed with his mother his plans for him when he had entered the Firm.

CHAPTER XXII

THE SENNAR DAM

The Sennar Dam—The Problem of the Nile—The Structure and Function of the Dam—The Sennar Site and its Advantages—Preliminary Work—The Time-table—Unwatering the River—A Race against Time—Bishop Gwynne's Tribute—Valparaiso Port Works—The Littleton Reservoir.

Among the contracts undertaken by the Firm after the war, that for the construction of the Sennar or Makwar Dam and irrigation works on the Blue Nile holds the first place. The object of this was to provide for the irrigation of the Gezira Plain, which lies in the triangle between the Blue and the White Niles to the south of Khartoum—an object which had long been in the minds of Egyptian and Sudanese administrators, and which, like all engineering schemes, had greatly appealed to Lord Kitchener, who in 1913 appointed a Commission to examine it and prepare a scheme.[1]

The Nile presents the engineer with the unique problem of a river which for four months of the year runs with an immense and superabundant volume of water, and for the remaining months of the year flows at the level of an ordinary river between banks. Since in the greater part of Egypt the rainfall is negligible, the whole life of the country depends on the regularity and adequacy of the flood. But this life would be very restricted if it depended on the natural flooding at the one season of the year of such land as is within reach of the flood, and from the time of the Pharaohs onwards the rulers of Egypt have sought means of storing the excess water and conveying it by irrigation canals to lands beyond

[1] This Commission consisted of Sir William Garstin, G.C.M.G., Sir Arthur Webb, K.C.M.G., Sir Murdoch Macdonald, K.C.M.G. and Mr. H. H. Maclure,

reach of the natural flood. Generation after generation, new cultivable lands have by this means been reclaimed from the desert, and the process has been greatly accelerated by the great dams and barrages constructed under British auspices in Egypt. The Sennar Dam was designed to bring 300,000 acres under cultivation in the Gezira Plain, and has actually up to the present time considerably exceeded this estimate and brought in some half million.

The simplest form of dam is a wall built across a river, with its foundations below the river bed, and raised to a height a little above the level (determined by the lie of the adjacent land) at which it is desired to contain the water. Below the water level this wall is pierced at intervals with arched openings through which the normal river flows downstream, its volume being controlled by sluice-gates inserted in the openings. The excess water beyond what is needed for the normal flow is thus held up on the up-stream side; and the dam is prolonged on either shore to form the boundary of a reservoir into which this water spreads out until it finds its level against rising ground, and from which it is conducted through sluices into irrigation canals. A Nile dam is so constructed that the maximum flood does not overflow the structure, which means that it must rise more than fifty feet from low-water level, and that openings or spillways have to be provided in the upper part of the structure in addition to the main sluices below water, so that the flood water—which at Sennar was about 5,000 cubic metres per second—may be safely carried off. These upper spillways or openings are of such a size and arranged in such a way as not to interfere with the raising and lowering of the main gates of the sluices below, and a further outflow has to be provided by somewhat wider spillways on either flank of these openings. All these openings and spillways are capable of being closed, if that is required. Then, lest the fall of the water should injure the material on the down-stream bottom of the dam, large blocks of stone projecting from the general surface (" baffle-stones ") are inserted along its whole face below the openings through which the water flows in the flood season. These break its fall and lessen its impact on the bottom. A

SENNAR DAM

glance at the accompanying illustration will show these various features.

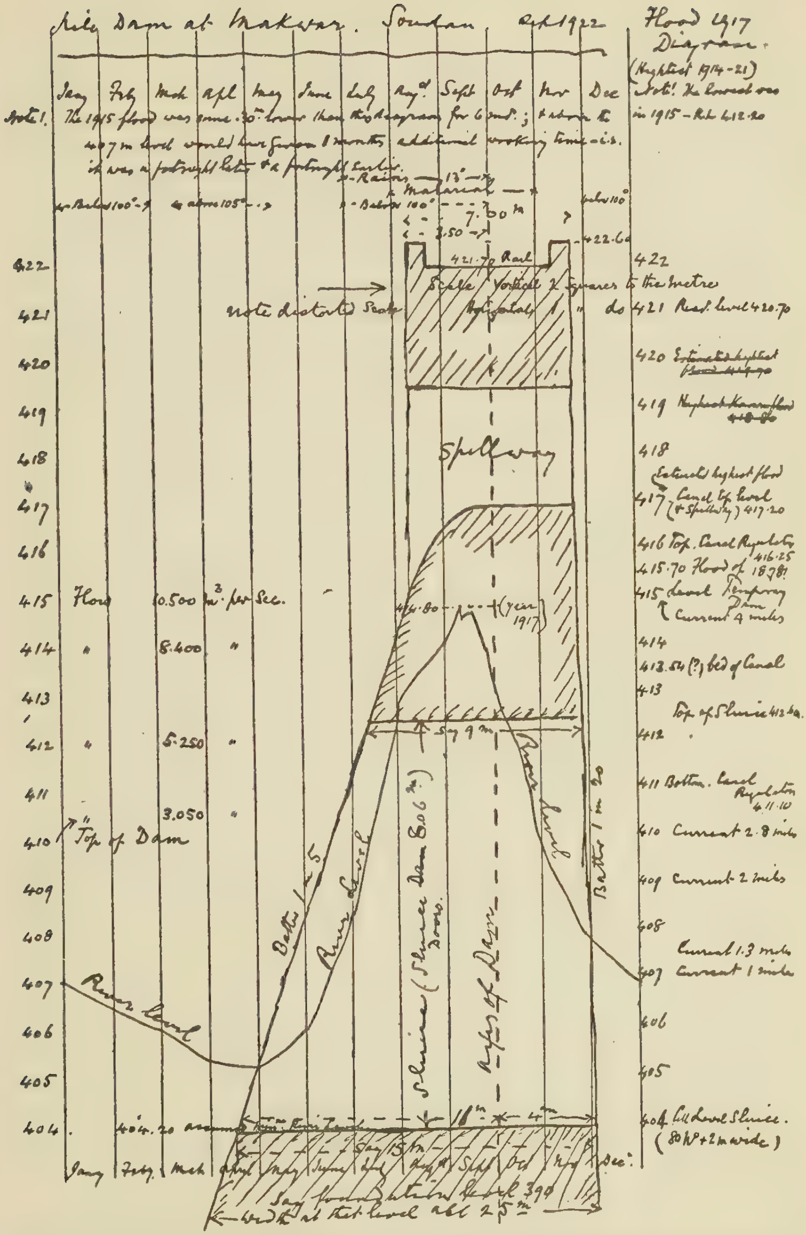
When completed, the dam, or that part of it which crosses the main channel, resembles a viaduct with a double row of arches, one above the other, the upper being open and above water, but capable of being closed, the lower under water and opened or closed by the raising or lowering of the sluice-gates. At high Nile the water rises nearly to the top of the structure on the up-river side and pours not only through the lower sluices but also through the upper arches and over the baffle-stones to the river below; at low Nile the upper arches are above the flow, but the waters held by the dam are still nearly fifty feet above the waters below and form a reservoir at a level from which the irrigation canals can be fed. The entire Sennar Dam is two miles long, and it had to be broad enough to carry lines for the Goliath cranes which work the main sluice-gates, and also to give room for a railway track. If the water could be drawn off, it would be seen as an immense double-decked viaduct rising 128 feet from a base 90 feet broad.

Sennar was chosen for this undertaking for three reasons: that the river is comparatively narrow here; that it was the only place where a solid foundation was obtainable, and that the presence of an island in mid-stream facilitated construction. It was decided that for the central part of the dam—about 6,000 feet in length—it was imperative to carry the foundations down to absolutely solid rock; but the excavation required to reach this foundation was so formidable—at one point in the eastern channel it was no less than 65 feet below the lowest water level—that it could only be carried out if the river were temporarily diverted and the working section " unwatered." This for so great a river as the Nile was an anxious and difficult operation, but the island furnished a convenient dividing line between the eastern and western channels, and each in successive seasons was enclosed by earthen and steel pile dams and pumped dry of water (" unwatered "), while the flow continued round the island through the other channel. It was always a race against time during the eight months of low

Nile, for the flood when it came quickly swept away the earthen dams, and the masonry constructed within them had to be built high enough to avoid the necessity of rebuilding these dams in the next season.

The scheme was finally laid down and work begun in the early part of 1914, but, except for a little handwork on the main irrigation canal, had to be suspended when the war came, and until it was over. It was taken up again in 1919, and entrusted to the Sudan Construction Co., which in the next two and a half years constructed a part of the western end of the dam, erected a village for the employees, and did a certain amount of useful preliminary work. But the work was proving far more costly than was expected; and the Sudan Government, after reference to the British Treasury, called for an independent report. Eventually the existing contract was wound up, and tenders were invited on a fixed-rate basis from six leading British firms. In October, 1922, the contract was assigned to the Pearson Firm, whose tender was the lowest, and they got to work on it before the end of the month—in fact at the first moment when the fall of the Nile permitted work to begin. Mr. (now Sir) Frederick Hopkinson was appointed Director in charge of the work, and Cowdray did not himself go to Egypt, but, as the records show, he worked out every detail with his own hand, revising all estimates, laying down a provisional time-table, and insisting always on a margin over the worst to be expected according to any previous records. The race against time presented a problem after his own heart, and he had from the beginning an exact estimate in his head of what had to be accomplished week by week in the eight months of low Nile if the work was not to be overtaken by the flood before it was in a condition to stand up against it. Mr. Hopkinson, too, worked out all these details, and the two men then compared notes and debated all doubtful points before the final plans were laid.

Under Mr. Hopkinson's direction the work went a little better than the time-table. During the season 1922-3 the western part was unwatered and the dam completed to its full height for a length of 5,000 ft., leaving an opening of 450 ft. between it and the island, through which the river


Nile Dam at Makwar. Soudan. Sept 1922
Flood 417 Diagram.
(Highest 1914-21)
Note! The lowest was in 1915 – Red. 412.20
Jany Feby Mch Apl May June July Augt Sept Oct Nov Dec
Note 1. The 1915 flood was some .30m lower than this diagram for 6 mos; & above the 407m level would have given 1 months additional working time – i.e. it was a fortnight later & a fortnight earlier.
Rains 13°
Material
Below 100°
above 105°
Below 100°
below 100°
7.80m
3.50
422.60
421.70 Rail
Scale Vertical 2 squares to the metre
Note distorted Scale
Horizontal 1 " do
Spillway
414.80
(year 1917)
Say 9m
Flow 10.500 m³ per Sec.
" 8.400 "
" 5.250 "
3.050 "
Top of Dam
Batter 1 in 5
River Level
Sluice (Sluice Dam 80 6m doors)
Axis of Dam
River level
Batter 1 in 20
River Level
404.20 assumed min. River Level
16m
4m
Say 15m
Jany Feby Mch Apl May June July Augt Sept Oct Nov Dec
Say foundation level 390
Width at that level abt 25m
422
421 Road level 420.70
420 ~~Estimated highest flood 419.70~~
419 ~~Highest Known flood 418.80~~
418
Extended highest flood
417 Canal top level (& Spillway) 417.20
416 Top. Canal Regulator 416.25
415.70 Flood of 1878!
415 Level Temporary Dam
Current 4 miles
414
413.54 (?) bed of Canal
413
Top of Sluice 412.60.
412
411 Bottom. Canal Regulator 411.10
410 Current 2.8 miles
409 Current 2 miles
408
Current 1.3 miles
407 Current 1 mile
406
405
404 Low Level Sluice. (80 No + 2m wide)
422
421
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EXTRACT FROM LORD COWDRAY'S NOTE-BOOK FOR NILE DAM CONTRACT, SEPT. 1922.

was diverted from the eastern section in the following season (1923-4). In that season the eastern or deep-channel section was "unwatered," the loose material on the bottom was taken out partly by grabs and partly by hand labour, until the rock foundation was reached, the foundation done, and 1,650 feet of wall built to the requisite height before the work was stopped by the flood. This was the really exciting season, and the excitement continued up to the last moment. There were some who declared it impossible to do all that had been laid out for this season—construct the temporary dams, both up and down stream across the deep channel, pump out the water, excavate for the foundation, and build up the entire work to the level of the temporary gantry across the river, i.e. 85 feet above the level of the lowest foundation—between the fall of the Nile in November and its rise in the following July. Yet it was done and had to be done, or the temporary dams would have been washed away as soon as the river rose, and it would have been necessary to reconstruct them at great cost in the coming season. More important still, the completion of the work would have been delayed for a whole year at a loss which may be measured by the fact that the value of the first year's cotton crop on the newly irrigated lands was about two million sterling. Actually the work was built up to the required level (and the top of the gantry removed to save its being washed away) before it was submerged by the rising of the relentless Nile.

For several months over 1,000 cubic metres of masonry, i.e. 2,600 tons, were built daily, and the total for the season was no less than 160,000 cubic metres, or over 400,000 tons. The labour was partly Egyptian and partly Sudanese (under British supervision), and at the busiest time in 1924 20,000 men were employed. The stone was obtained from the low granite hills rising out of the plain about twenty miles inland at Gebels Moya and Segady, and a railway line was run out to bring it in. The cement was made locally, and about 1,200 tons was turned out per week. In addition to this work on the dam, the construction of 585 miles of irrigation canals, masonry regulators, etc., was in active progress, the whole work covering a space of ninety miles by twenty, and the mere inspection of it requiring journeys by motor as long as from London to Brighton and back.

In the following season (1924-5) the masonry of the eastern portion was built to its full height and the sluices placed in position. Temporary embankments having in the meantime been built up-stream and down-stream in the western section, that was next " unwatered " and the river again diverted round the island to the eastern section and permitted to flow through the sluices of the completed part of the dam. This was effected by the beginning of February, and within a month the lower portions of the masonry had been got in through the whole width of the western section, and the western and eastern sections linked up at the island. It now only remained to complete the masonry to its full height, and this was easily accomplished in the next month. The Firm had agreed to complete the contract in July, 1925 ; actually they delivered the finished dam at the end of June of that year, and the canals connecting it with the Gezira area were ready a week later. When the dam was completed the water was held up behind it as far as Singa, a distance of about fifty miles.

Finally, in the following January, the dam was opened in state by the High Commissioner, Lord Lloyd, who made handsome acknowledgment of the work of the Firm and its able and zealous representatives, Sir Frederick Hopkinson (who received the honour of knighthood), Mr. J. W. Gibson, its agent in charge, and Mr. Le Clercq, its engineer. Later in the year the Firm received its bonus, with a covering letter from the Financial Secretary to the Sudan Government :

Sudan Government,
London Office,
July 20th, 1925.

Dear Sirs,

I have much pleasure in handing you herewith a cheque for £153,846 3s. 1d., being the equivalent for £E150,000, which is the bonus to which you are entitled under Clause 72 of the Contract.

I should like to take this opportunity of congratulating you on having thus accomplished a great work which will be a permanent monument in the Sudan to your Firm, and especially to Sir Frederick Hopkinson and the members of your local staff.

I am,
Yours faithfully,
(Signed) George Schuster,
Financial Secretary,
Sudan Government.

Messrs S. Pearson & Son.

Incidentally, Sir Frederick Hopkinson remarked that it had cost him £300,000 to earn this sum.

The completion of such a work in thirty-one months was an extraordinary feat and one without parallel in any European undertaking. It was rendered possible in Egypt by the stress of the conditions, by the unlimited labour available, the rainless climate which enabled it to be housed in tents, and the careful supervision and organization of the whole work. Contractors and engineers agreed that Egyptian labour was among the finest in the world, but it needed careful and sympathetic handling. The Egyptian labourer will do things in his own way—the way of his forefathers—but not in any other way. If attempts are made to force him, he will go home. But in his own way he could hardly be surpassed. The photographs of the successive stages of the work show him swarming over the ground in his white gallabiyeh, working busily in his gang, active, energetic, plodding. Those who recall the scene can still in memory hear the sound of his long-drawn song above the noise of the cranes and engines. He was well cared for; the Sudan Government provided excellent hospital accommodation, and owing to the precautions taken there was very little sickness.[1]

Among the many tributes which came to the Firm on the completion of their work there was none which it valued more than a letter from Dr. Gwynne, Bishop of Egypt and the Sudan, acknowledging a subscription of £500 from the Firm towards the construction of the tower of Khartoum Cathedral (March 20, 1925). The Bishop wrote:

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[1] There was only one European death during the whole period of construction.

> I do indeed congratulate the Firm on the great accomplishment of the erection of the Dam across the Blue Nile; and I should like to say, on behalf of those who are interested in the natives of the country, how well they have been treated by the Firm. There are some of us who feel that the fair and humane treatment that they have received has won the confidence of thousands of natives who can bear witness to the uprightness, integrity, and personal regard of those Englishmen with whom they had dealings.

To Cowdray it was a special satisfaction to find that, in spite of the interruptions of the war, the organization of his Firm and its capacity for handling great and difficult undertakings were still unimpaired. He was specially appreciative of Sir Frederick Hopkinson's part in the work and said subsequently to his son that no man living but Hopkinson could have done it in the time.

Another great work which was in progress during these years (and is still going forward) was that for the improvement of Valparaiso Harbour on the two contracts with the Chilian Government, obtained by Sir Edward Pearson, as already recorded. This was handled by Sir Edward Pearson, and Mr. A. C. Walsh, representing the Firm on the spot, and Mr. W. F. Stanton, acting as Chief Engineer. Cowdray did not visit it in person, though he watched and supervised with his usual thoroughness. The work included the building of a breakwater in very deep water on an unusually treacherous sea-bottom, and the construction of various sea-walls, quays, jetties, wharves, railways and warehouses. Few of the harbour problems with which the Firm had had to deal presented quite the same combination of difficulties. The great depth of water exposed the whole shore line to heavy wave-strokes, which required sea-walls and quays to be of the strongest construction; it was difficult to find any firm foundation; there were violent storms, and earthquakes of greater or lesser intensity had always to be reckoned with. The engineers displayed special ingenuity in dealing with the more difficult parts of the breakwater, where the problem was solved by the use of immense monolithic blocks each weighing 12,000 tons, the shells of which were sunk into the sea-bed and afterwards filled with concrete. This work proved once more the advantage which the Firm enjoyed in being in a position to provide the very best equipment and to meet unexpected difficulties with composure.

The other principal contract of these years was for the great Littleton Reservoir of the Metropolitan Water Board. This is situated on the north bank of the Thames between Staines and Shepperton, and with its water surface of 720 acres and its capacity of 6,750 million gallons, is believed to be the largest artificial reservoir in the world. The many and complicated processes which go to the making or extension of a modern water-supply, the intake, the outlet, the pumping, screening and filtering, the handling of the water at different levels and its direction to where it is needed, are necessarily the work of many hands and brains, but to the Pearson Firm fell all the constructional part of the work except the small part that was begun before the scheme was held up by the war. It was in mere size an immense work. The space marked out for the reservoir had a circumference of about four miles; and it had to be excavated to an average depth of six feet over the whole site and surrounded with an embankment rising thirty-eight feet above the average ground-level, so as to provide for a depth of thirty-eight feet of water and a margin of six feet between the water-level and the top of the embankment. There was also what is called a baffle bank four thousand feet long thrown out from the northern bank to ensure the circulation of the water between inlet and outlet and reduce the height of waves formed by the wind. Over and above the construction of the reservoir, there was a great variety of other works—bridges, tunnels, sluices, conduits, etc., of a kind with which the Firm was thoroughly familiar. The special difficulty was the running sand in the foundations, which had to be dealt with by varying the contour of the embankment. The work went forward under the direction of Sir Frederick Hopkinson and Sir Edward Pearson during the five years from 1919 onwards, and the finished Reservoir, which provides London with an immense new supply of water, was opened by the King on June 13, 1925.

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It has been impossible to do more in this book than describe a comparatively small number of the enterprises carried out by Cowdray and his Firm. But this inevitable selection has left unrecorded the efforts of many who rendered great services to him and the Firm ; and it seems fair to repair that omission by saying that no history of the Firm would be complete without mention of the names of : Mr. E. J. Allen, Mechanical Engineer in charge of the pumping plant on the Malta Dock contract and afterwards in charge of the Buying Department at 10 Victoria Street ; Mr. J. A. Assheton, Managing Director, and Mr. T. L. Bonstow, Chief Engineer of the Mexican Eagle Oil Company ; Mr. J. de C. Ballardie, Secretary, and Mr. F. J. Bayley, Engineer of the Whitehall Petroleum Corporation ; Mr. A. Colls, who joined the Firm in 1891 and has been Secretary to S. Pearson & Son since 1919 ; Mr. J. S. Evernden and Mr. W. J. H. Hunter, Assistant Secretaries of the Whitehall Securities Corporation ; Mr. H. H. Goldney and Mr. H. F. Berry, Directors of the Firm's Road Companies ; Mr. C. M. Hunter, for twenty years Manager of the Orizaba Jute Mills in Mexico ; Mr. R. D. Hutchison, Secretary and later Vice-President of the Mexican Eagle Oil Company ; Mr. F. J. Miller, for many years General Manager of the Firm's Electric enterprises in Mexico ; Mr. C. J. Newman, late Secretary of the Contracting Company ; Mr. C. W. Sharrock, Manager of the Wouldham Cement Works ; Mr. C. H. M. C. Wilson, Secretary of the Anglo-Mexican Petroleum Company.

CHAPTER XXIII

LAST DAYS

Quitting Cowdray—Developing Dunecht—Other Scottish Estates—The Duties of a Land-owner—Gifts and Donations—St. George's Chapel, Windsor—The Royal Air Force Club—The College of Nursing—Lord Rector of Aberdeen University—The Rectorial Address—Cowdray and the Liberal Party—Winding up the Contracting Department—Last Months and Death.

In April, 1919, Cowdray passed on the great estate in Sussex[1] from which he had taken his title, to his eldest son, Harold. "It is a great joy to both of us," he wrote in answer to a letter from his son, "to get your letter in appreciation of Cowdray. May you and yours enjoy for many long years its charm and all the advantages carried by its ownership. It is truly a princely estate, and notwithstanding my camouflage, it was a real test of our love, our passing it."

His original idea had been to build a new Cowdray House at the top of the Park and commanding the magnificent view from that spot, but for various reasons this scheme did not go forward. Instead he altered and improved the existing house and devoted a great deal of thought and care to the repair and preservation of the beautiful ruin of the old Cowdray House, which stands in the Park, and of the Priory of Easebourne, which is part of the property. In repairing the ruins, it became necessary to pull down the ivy which was destroying the stone-work, and articles appeared in certain newspapers criticizing this part of the work. As a result, the Secretary of the Society for the Preservation of Ancient Buildings paid a formal visit of inspection and was met by Cowdray and Sir Aston Webb. He said no word

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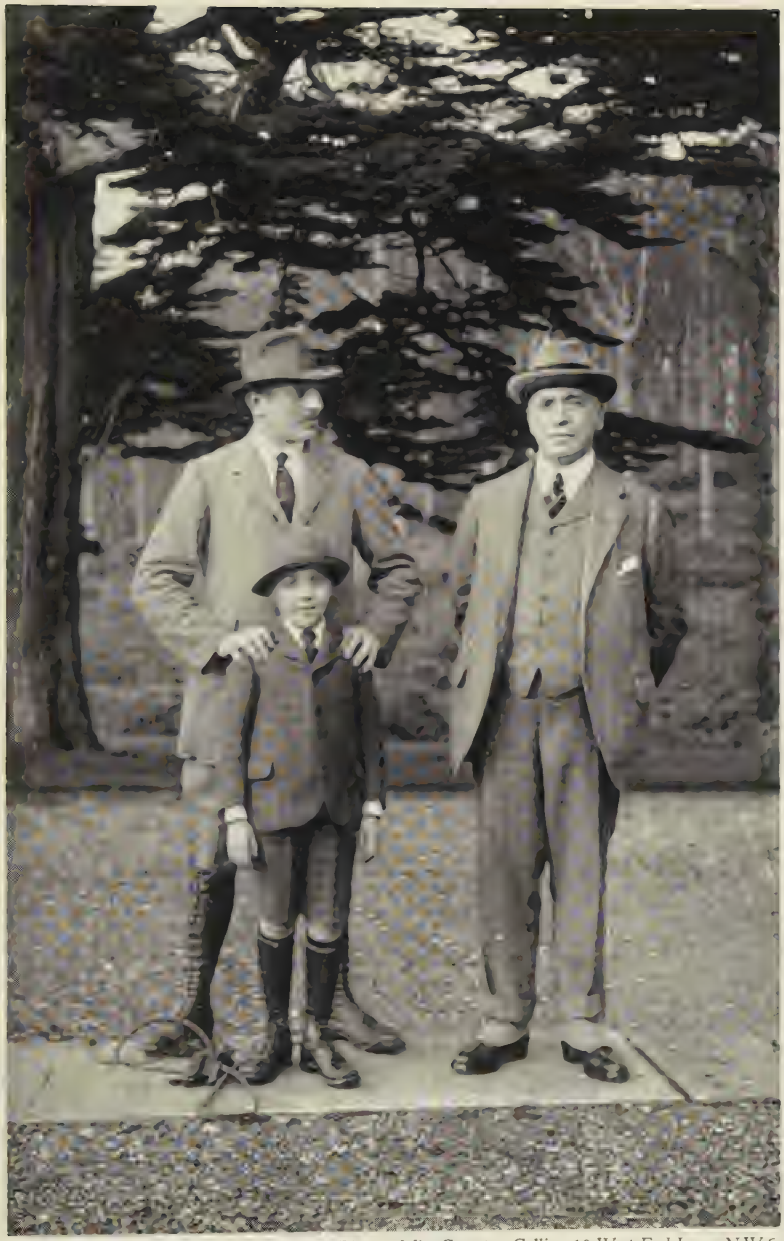
[1] Weetman Harold Miller Pearson, now Viscount Cowdray, married in 1905 Agnes Beryl, younger daughter of Lord Edward Spencer Churchill; son and heir, Weetman John Churchill, born 1910.



[*Photo : Miss Compton Collier, 10 West End Lane, N.W.6*

THE THREE GENERATIONS (1918).

On right, THE LATE VISCOUNT COWDRAY; on left, HAROLD, now VISCOUNT COWDRAY, and his son, WEETMAN JOHN PEARSON

during the inspection but at the end of it warmly congratulated Cowdray on what he described as a national service.

Cowdray retained Paddockhurst for his country home in England, but the property of Dunecht in Aberdeenshire, which he had bought in 1908, was now and to the end of his life his chief home in the country, and there he and his wife entertained their friends in the autumn and spring. The immense house, with its spacious grounds and woods and lochs, gave him just the opportunity he loved for reconstructing and engineering, and in ten years he altered them out of knowledge, and incidentally provided employment in the hard times for a great many deserving neighbours. In former years Dunecht had been chiefly known to the public for the audacious body-snatching practised on the third Earl of Crawford and Balcarres, the former owner of the estate, who built both the house and the beautiful chapel which is its principal feature. Whatever spell the superstitious may have supposed to have been cast on the place by this incident was quickly broken by the cheerful Cowdray touch.

Dunecht, however, was not enough. To it, in the next two or three years, were added the Forest of Birse, the Raemoir estate and the Kirkville estate, making in all nearly 28,000 acres, and including grouse moors, farms and many beautiful and interesting houses. He also acquired the famous Dunnottar Castle on the coast of Kincardineshire, and after careful repairs opened it to the public. In the meantime his second son Clive had bought and made his home in Parham Park, with its famous Elizabethan house under the Sussex Downs. To Clive also his father gave Castle Fraser, a fine old Scottish house close to Dunecht. During the same years he became possessed of a considerable number of well-known pictures, both old and modern, and a list of the more important of these will be found in Appendix No. IV (p. 303).

From quite early years traces may be found in Cowdray's correspondence of his ambition to found a family on an enduring basis, and he went the traditional way to work of acquiring large properties. He saw his family on the one hand entrenched in the great business house in which they all had shares, and on the other possessed of estates which would be secure to them so long as the business was wisely conducted. But he held strongly that land-owning needed the same serious care and attention as business, and much of his time and thought in later years was given to improving his estates and making life easier for his poorer neighbours. In this he was greatly helped by his wife, who shared his view that the villages on the estates should have the best of everything—cottages, school-buildings, clubs, playing-fields. To provide these needed not only money, but careful thought and planning and the co-operation of those whom they were intended to benefit. It may be added here that among the landed possessions of himself or his Firm was a large riverside property near Grays, on the Essex shore of the Thames, which he had acquired some years earlier and kept in reserve as a possible site for an oil refinery. In the last years of his life he was turning over in his mind schemes which have yet to be realized for the general development of this land with its river, rail and road facilities.

Cowdray was all his life a generous giver, and in his last years donations to charity and public purposes may be traced amounting in the aggregate to considerably more than a million of money, in addition to the always steady flow of private benefactions of which no record was kept. When, on the outbreak of war, it had been decided that the King Edward VII Sanatorium at Midhurst must be closed owing to the cost and difficulty of keeping it supplied, he at once offered to guarantee any sum that might be needed to keep it open, and though, as it turned out, his help was not required, his offer at this timely moment appears to have been the decisive factor in keeping the Sanatorium open during the war. When the war was over, it was mainly through his aid that it was possible to carry on the restoration of St. George's Chapel, Windsor. The defects in the roof which were revealed when the plaster applied by the eighteenth-century restorers had been removed, proved to be much more serious than had been suspected, and faults of construction were discovered which made the work of repair both urgent and costly. The unique flat roof—the flattest ever attempted—with its great width and narrow bays, was found to be lacking in the securities usual in that type, and they needed to be provided at once. Cowdray recognized this to be a work of national importance, and in the next four or five years provided the large sum of money necessary to keep it going and took a continuous personal interest in its progress. Another donor has come forward since his death with a further generous contribution for the completion of the work, which has proved more costly than was anticipated, but Cowdray enabled the restoration to be begun and provided what at the time was thought to be an ample sum for all purposes. It may be added that he had intended his gift to be anonymous, and it was not by his act that it became known.

Another scheme which took shape under his own hand, and was perpetually enlarged to meet his view of what the occasion required, was that of the Royal Air Force Club, now established in a noble club-house at 128 Piccadilly and 6 Park Lane. Cowdray's part in this began in 1918 with a guarantee of £10,000 to carry on the Club in Bruton Street, on which till then Mr. Walter Bersey had paid the annual deficit, but this was only a stop-gap measure, and a little later he offered £100,000 to establish the Club on a permanent basis. But this again proved unequal to the design which he had in mind, and before the building was completed and the permanent basis secured, his contribution had mounted up to £347,000. Thus he commemorated the Airmen who had fallen in the war, and kept in memory his Presidency of the Air Board and the part he had played in organizing the Ministry for Air. His guiding thought in founding this Club, and providing a constantly increasing sum for its equipment and adornment, was that the Air Force coming new on the scene without the traditions which steadied and disciplined the older services needed specially to be housed in a manner which would appeal to its pride and uphold its status and dignity. When the plans were being worked out, he was specially insistent on the accommodation for entertaining ladies being ample.

At the same time he and his wife together bought 20 Cavendish Square—the residence for so many years of Lord and Lady Oxford—and converted it into a College of Nursing, which with the "Cowdray Club" for nurses and other professional women that is housed in the adjoining buildings required from first to last an expenditure of £147,000. This, too, was a labour of love, on which not only money but care and thought were spent without stint. Cowdray sat for hours with the architect, Sir Edwin Cooper, going through the designs and entering into the smallest details. As a war memorial and as a gift from himself to the town of Midhurst, he presented the Midhurst Grammar School with an adjoining house which belonged to the estate, and built up a connecting link between the house and the school, thus providing accommodation for seventy boarders. In a speech at the opening ceremony he said that the boy who got most out of education was the boy who learned with difficulty, but nevertheless learned ; the boy who learned easily ran the great risk of missing the most important side of character-building, which was learning to develop grit.

In the same two or three years he gave £100,000 to the Cowdray Hospital, Mexico City, founded at an earlier period ; £50,000 to the League of Nations Union ; £50,000 to the endowment fund of the Cambridge University Chemical Department ; £50,000 to the Royal Infirmary, Aberdeen ; £25,000 to the Birmingham University School of Mining ; £20,000 to the reconstruction of the Engineering Buildings of University College, London ; £20,000 to the Cowdray Hall and Art Museum, Aberdeen, and numerous smaller sums for such objects as the foundations of chairs of Spanish at London and Leeds Universities, a chair of Forestry in Aberdeen University. The objects chosen show fairly the range of Cowdray's interests and his principle in giving, which was not to scatter money to all-commers, but to choose carefully and give generously so that the results might be sure and permanent.

In the time of his prosperity Cowdray always kept in mind old friends and relations who had been less fortunate in the battle of life. From the year 1900 onwards, he asked Mr. George Whiteley of Harrogate, to act as his almoner for this purpose, and to open a banking account, for which he supplied the funds. The correspondence between them and with his aunt, Mrs. Whiteley, who took up the work on the death of her husband in 1924, shows his unfailing interest in the fortunes of any who had a reasonable claim on him. " Be wise in your charity, erring on the side of generosity, if there be error," he writes in a letter in which a cheque for £450 is enclosed. "I hope you will exercise your discretion of contributing whatever may be desirable," he writes a little later, "even if the allowance should be exceeded." Again and again he shows himself uneasy about some old workman who has not had a retiring allowance, or who may have been dismissed, after good service, owing to some failure to give satisfaction on a particular job. His almoner is asked to inquire into the case of an old time-keeper who went from Dover Harbour "after some friction," and instructed to allow him £4 to £6 a month, and, if or when he dies, to give a gratuity of £10 and a continuing allowance of £1 a week to his widow. Another old man with a similar history is to be "assisted to the extent that may be necessary for him to be thoroughly comfortable, and give him £1 a week when he is in work, and double it when he is out of work." All the old beneficiaries of this charity are to be put in a position to "live comfortably without the old age pension."

In 1920 he was elected Lord Rector of Aberdeen University—receiving the rare compliment of a unanimous choice—and on October 22nd he delivered his Rectorial address to the students. This will be found reprinted in full at the end of this volume (Appendix II). The chief part of it was reported by newspapers all over the country and evoked widespread attention and comment. Taking as his subject "Labour, its Problems and the Ideal Wage," he entered into a cool and judicial analysis of the supposed panaceas for industrial trouble—communism, socialism, syndicalism, and the like—and pointed out that none solved the problem of a just distribution of the product between the various factors which co-operated in production. That being so, we might leave them out of account for the time being and consider on its merits what in a well-ordered society would be the just distribution—what, as he put it, would be the "ideal wage" for labour. There were, he laid down, three factors in such a wage: first, a guaranteed minimum to enable the worker to maintain a decent standard of existence; second, a variable quantity according to the output of the individual; third, a variable addition according to the result of the undertaking

—to put it shortly, piecework with a guaranteed minimum and a bonus on profits. Starting from this, he boldly faced the difficulties of the third factor—the bonus on profits and the share in management for the workers which would logically follow from it. While admitting that they were formidable, he argued that they could be overcome, if labour and capital seriously applied themselves to overcoming them and were content to advance by degrees. Finally, he expressed his belief that this in the long run would prove the only way of establishing peace and preventing the struggle for the division of the profits of industry becoming a blind tussle of forces.

In another part of the same address he gave his adhesion to the principle of unemployment insurance which was later to be adopted but at that moment was subject to much debate and criticism. His final words were :

> No one can think the present solution satisfactory or final, and, since those who are called capitalists are in possession, it is for them especially to exert themselves to find remedies for evils which, however unfairly, will be laid at their doors. I suggest that if we could make the principle of what I have called the " ideal wage " our aim, and endeavour to adjust our machinery accordingly, and at the same time address ourselves seriously to the problem of unemployment, we should go a long way to compose strife and open the road to the mutual partnership and co-operation which will alone make industry efficient, and increase the total wealth in the measure in which it can and should be increased. My own opinion is that if these problems were solved, or even appreciable progress made in their solution, it would become evident that the greatest advantage lay in leaving the widest liberty to individual endeavour, enterprise, and adventure. But even if I were wrong, a mutual effort to find their solution, in which Labour and Capital, and men of all shades of thought, honestly took part, could not at all prejudice the contrary opinions.

It can only be said that the course of events in the subsequent eight years has confirmed the general judgment at the time that Cowdray struck the right road in this address, but so bold a lead and frank acknowledgment from a great employer and capitalist of the co-operative nature of the process of wealth-production and of the necessity of giving expression to it in the organization of industry struck the public as new and significant at the time and still remains a pointer to other capitalists and employers.

Cowdray kept his touch with politics during these years, and never doubted that the utmost efforts should be made to keep the Liberal party in being through the difficult days which followed the war. He attended the " Shadow Cabinet " meetings under Lord Oxford, and in the question which arose between Lord Oxford and Mr. Lloyd George in the year of the General Strike, he was unhesitatingly on the side of the former, and contributed generously to the gift which a group of his friends made to Lord Oxford on his retirement from the leadership of the Liberal party. Privately, he expressed the opinion that Lord Oxford's case in his controversy with Mr. Lloyd George had been badly handled, and asked a little anxiously whether anybody had looked ahead into a situation in which all the material advantages were so evidently on the other side. The question which he put to Lord Oxford's friends, " What are you going to do next ? " was, indeed, difficult to answer, for the plain fact was that Lord Oxford had acted on what seemed to him imperative grounds without stopping to consider it, and both he and Cowdray were to pass from the scene before it was answered. But to the end he watched with keen interest the effort which a group of Liberals were making to remain independent of Mr. Lloyd George's fund, and did all he could to help them to keep their flag flying.

It was suggested after his death that he had acquired and " used " the *Westminster Gazette* to pursue a personal quarrel with Mr. Lloyd George arising out of the manner of his withdrawal from the Air Board in 1917. It would be foolish to say that he did not feel keenly the lack of consideration with which he was treated on this occasion, but he was one of the least vindictive of men, and whatever his feelings may have been, he was altogether incapable of using a newspaper that he owned to vent his personal feelings upon a public man. At the time of his resignation from the Air Board, he was one of the eight principal shareholders in the *Westminster Gazette*, and had been so for the previous nine years. It is, therefore, absurd to suggest that he acquired the paper at this time and for the purpose alleged. When four years later he became sole proprietor of the paper, his motive was solely to keep alive what he believed to be a useful effort on behalf of independent Liberalism, which was then in great difficulties, and I am in a position to say that neither as shareholder nor as sole proprietor did he ever suggest to its editor that attacks should be made on Mr. Lloyd George. Undoubtedly he wished the paper to stand for an independent Liberalism against the Coalition which threatened it with extinction, but there was in this no question of personal hostility to Mr. Lloyd George.

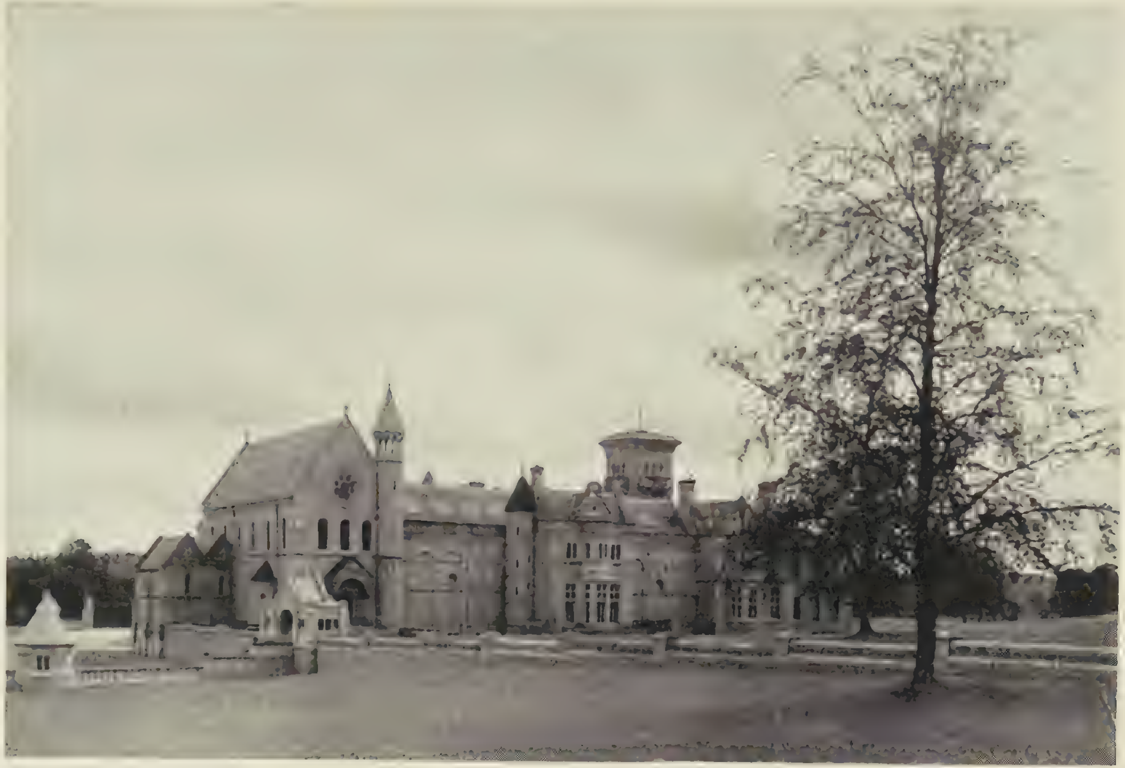
During these years the Firm was engaged on two of its greatest contracts, the Sennar Nile Dam and the Valparaiso Breakwater extension, and though Cowdray visited neither of them in person, the records show him still, as in previous years, watching and checking at every stage. There were various minor works going forward, such as the Stanlow Oil Dock on the Manchester Ship Canal, the construction of a storm relief sewer for the London County Council and a Reservoir for the Belfast Corporation, dredging for the Dover Harbour Board and the like, but by this time his mind was made up to close down this side of the business. Contracting, as he used to insist, was a one-man job, and the course of events was gradually transforming his organization into a great Investment Trust controlling and directing numerous enterprises at home and abroad, which would need all his time and thought, and that of his sons and partners. At this point he might undoubtedly have disposed of the goodwill of the contracting part of the business or converted it into a public company, with others to direct and manage, and there were some who thought him foolish not to have done so. But he had a strong sentiment against permitting the name of Pearson to be used for any enterprise in which the management and control were not in Pearson hands, and he was clear that the brilliant and undefeated chapter of "S. Pearson & Son, Contractors," must be closed on his departure. If in the future the Firm did work of this kind, it would be for itself and on its own properties, in the Kent Coalfields and elsewhere.

He was as active and busy in these last years of his life as in any that had gone before, and as ready as ever for new schemes and enterprises. He was oftener and for rather longer periods at Dunecht, but if he left business behind him, it was to plan and scheme for his estates and lay out the next thing to do. In 1923 he paid a two months' visit to the United States, and in the following years went to Carlsbad in the summer and Italy in the spring. The death of his brother, Sir Edward Pearson, in November, 1925, was a heavy blow which greatly depressed his spirits. The two brothers had always been warm friends ; Sir Edward had for years been a partner and director in the Firm, and it was no mere fraternal partiality which led Cowdray to set a high value on his abilities and to treat him as an intimate in the conduct of the Firm.

At the beginning of March, 1926, Cowdray had what was diagnosed as a " slight heart attack," but what proved to be the beginning of serious illness. He was ordered complete rest, and remained in bed at Carlton House Terrace for several weeks. But he was well enough to go to Paddockhurst on June 11, and a fortnight later returned to London and visited his office. But rest was still the imperative order of his doctors, and on July 23 he went to Dunecht with his wife, who was strong on the point that the doctors' orders should be obeyed. Lying fallow was never to his liking, but this time he resigned himself, being cheered by the assurance that there was no organic mischief, and that he might look forward to a return to reasonably good health if he submitted for the time. He was happy in the country, and his spirits rose as his health mended. All through the autumn and winter he reported himself as " progressing to the full satisfaction of his doctors," though admitting that it would be several months before he was " relatively a free agent," and that even then the word " relatively " must be borne in mind, since he had strict injunctions not to forget that relapses are easy. When the spring came these hopes seemed to be more than justified, and the doctors pronounced him well enough to permit the date to be fixed and preparations pushed forward for an occasion to which he had greatly looked forward—the conferment upon him and his wife simultaneously of the Freedom of the City of Aberdeen. The date fixed for this was May 3, and several members of the family arrived at Dunecht on April 30 to be with him and Lady Cowdray at this time. He seemed to be in the highest spirits and for the first time since his illness, fourteen months earlier, really his old self again. Then on the morning of the next day, May 1, he died in his sleep. Only the day before, his hopes had run high of having another eight or nine years for a last new enterprise, and once more he was planning for the time ahead.

Three days later a farm wagon drawn by two horses took him to his last resting-place in the little churchyard in Echt, and there his wife and family and co-directors and partners stood by the graveside. Aberdeen and Colchester sent civic deputations and a great throng of neighbours and tenants came from the country-side. Simultaneously there were memorial services at St. Margaret's, Westminster, at Colchester, at Easebourne, the Parish Church of Cowdray, and at Worth, the Parish Church of Paddockhurst. The King and Queen, who had frequently visited Dunecht in the last years, telegraphed a message of warmest sympathy to Lady Cowdray; another frequent visitor and old friend, the Archbishop of Canterbury, conducted the service at St. Margaret's, and spoke of his " long life of notable service and benevolence." The Prime Minister and many members of the Cabinet and public men of all parties expressed their sense of loss that the country had sustained by his death.

Indeed few men of this generation have received such a tribute as fell to Cowdray on his passing from the scene. As if to correct the common judgment which reserves the highest honours to the Parliamentarian and the politician, newspapers of all shades of opinion seized the occasion to dwell on the constructive and engineering feats that he had accomplished in his lifetime and their value to the world. American newspapers, more accustomed to bring this judgment to bear, were unstinted in their praise. One spoke of his " record for daring, originality and ingenuity that will last in the



[Photo W. & E. Drummond Young, Edinburgh

CHAPEL AND WEST FRONT OF DUNECHT

memories of men ;" another described him as " one of the greatest pioneers ever sent out by Britain ;" others recalled the courage with which he had tackled the dangerous and difficult problems of the Hudson and East River tunnels, and declared them to be " an enduring monument to Weetman Pearson." It may be truly said that the world is full of these enduring monuments.

The two caskets and " burgess tickets " conferring the freedom of the City of Aberdeen were presented to Lady Cowdray at a later date, but in the meantime it was arranged that the speeches which they intended to deliver should be published on the day of the funeral, and Cowdray's will be found in an Appendix to this volume (No. III, p. 300).

CHAPTER XXIV

THE SECRETS OF SUCCESS

The Secret of Cowdray's Success—His Own Witness—Some Notes and a Memorandum—Writing Things Down—Fairness and Considerateness—Straightforward Dealing and Good Workmanship—The Constructive Engineering Mind.

What was the secret of Cowdray's success? That question may, I hope, to some extent have answered itself as the story of his life has gone forward, but it remains to record his own testimony and to gather up a few leading points.

Cowdray could with difficulty be persuaded to talk about himself, but he left behind him certain written fragments which reveal his own thoughts. The chief of these are certain notes written or dictated just before his death as material for the speech which he had intended to make in acknowledging the freedom of Aberdeen, and partly used in that speech as afterwards published; and second, a memorandum on the conduct of the business which he prepared for his son Clive, who was destined to become Chairman of S. Pearson & Son Ltd. and head of the Firm. The notes take the form of advice to parents and children about the choice of a career:

> I am frequently asked by anxious parents how their sons can best get on in life. Very often the inquirer appears to think that there must be an easy way, a royal way, in fact some short cut, and that if I will only divulge the secret to him, the success of his children in after-life will be assured. I have to admit to him that I am ignorant of any secret knowledge, and further

that there is not any positive or certain method, although brains, hard work and patience usually succeed, that will secure the fulfilment of one's reasonable ambitions.

If the conversation is continued I try to make my friends realize that success demands many qualities, such as determination, unfailing courage, consistency, perseverance, one's best efforts without intermission and without rest, and inexhaustible patience.

It is astonishing to find the great number of people who fail to reach their goal for lack of staying power. They cannot continue their efforts day by day for an indefinite period when they are not seeing results. They lack faith in themselves and quit for something that looks more promising. They forget that a rolling stone gathers no moss.

Some golden rules to bear in mind :

1. Be sure that the career you are embarking upon is going to be congenial to you, that you have an aptitude for it and that you can put your whole heart and energy into it. Your business in life should also become your great pleasure.

2. Work hard and be patient. Do your best each and every day. Whilst doing your best hour by hour throughout the day and using up to the point of safety what energy and strength you possess, always remember not to overstep that point, as to-morrow you will have again to carry on.

Avoid grieving about results. No one can do more than his best. To give his best he must be able to avoid allowing his health or strength or time to be taken up by worries. If you allow yourself to be overborne by them your views become disjointed and you see everything in a wrong proportion.

3. Over-confidence is disastrous ; want of confidence leads nowhere. Hence in life the due adjustment of caution with adventure is necessary to success. Life is short ; a mistake made may paralyse years of hard work ; on the other hand, an opportunity missed may never recur. Thus every problem that presents itself has to be viewed and analysed from two standpoints :

the first, what can I make out of the enterprise ; the second, what can I lose by the enterprise ?

4. Of course it is well to distribute your risks. Don't have all your eggs in one basket for fear you may stumble. Be careful to see that the eggs are in baskets which can be kept under your eye and which are therefore carefully handled and will safely reach their destination.

5. Trust your associates, but of course be particularly careful in your choice of them. Never fail to give all the credit possible where credit is due. Many men, large and brilliant in other ways, are very small in this respect, and are apt to apportion too much of the credit to themselves. Be impartial, and err, if at all, on the side of bestowing too much rather than too little credit upon others.

It will save many heartaches if each youth before entering upon his career has finally decided, after long and careful analysis, what craftsmanship, or trade, or profession he can do best. Probably success or failure depends upon a rightful decision. Unless our work is so congenial that it is also a great pleasure, our best efforts are not forthcoming. By best efforts I mean devotion with our whole soul and energies to the work we have in hand.

Speaking for myself, I always found the day too short for the work I wished to do. It was a daily matter of regret that the clock travelled so quickly. I was able to concentrate my thoughts upon the work I was doing, and I believe I can conscientiously say that they seldom wandered from it.

It is easy to lose one's road, to take the wrong turning, and largely to waste one's energies in having to retrace one's steps. To minimize this risk, it is necessary to study each problem from every point of view. Each problem must be considered and reconsidered before definite action is taken. It is easy to believe that a programme has received the fullest consideration. But when one writes down the whys and the wherefores of each proposed step it will be found that this coldblooded analysis gives a very different result from any general or vague thinking. I therefore suggest that those having a problem to solve should do so by presenting to themselves in writing the case for and against before the final decision is taken.

It is imperative that one should know one's trade from A to Z. This knowledge must be exact and definite, as upon it we have, day by day, to base our calculations and to arrive at our decisions. Without definite knowledge there cannot be real confidence, and without confidence definite action should not be taken.

Side by side with this may be put another series of notes which also he had apparently intended to use in some public speech :

> Do it with all thy might.
>
> This means strenuous high-pressure work the whole time. (Result little interest I took in Parliament.)
>
> Do not fritter away your energies ; concentrate them.
>
> All undertakings (virtually without exception) in which we are interested, we control.
>
> Deal not only fairly but generously with your men and employees.
>
> And trust them fully.
>
> Consequence is devoted men who try not to be behind their leader in strenuous hard work.
>
> Success requires in my business :
>
> (*a*) That practical knowledge which the foremen possess.
>
> (*b*) That commercial knowledge a trader must have to succeed.
>
> (*c*) The technical, imaginative, and analytical knowledge and qualities that prevent improbabilities being undertaken or considered, and enable every ounce of experience to be utilized in the thousand and one problems a contractor is frequently running against.
>
> (*d*) An ability to get around you devoted and competent men of all grades.

The memorandum left for his son deals specifically with the qualities needed for the conduct of a great business, and the leading principle laid down in this is that one will must rule and that this will must be asserted fearlessly against divided counsels :

> Do not allow any responsibility to be taken by any colleagues beyond that which you give them. Care will be necessary to keep them within the limits you allow. The limits you grant will be controlled by the personal demands on your own time. Probably a committee meeting, for a few minutes only, would be desirable at frequent intervals, if not daily, at which each would properly report verbally what he was doing.
>
> All decisions taken must be those of which you fully approve. Avoid compromise decisions made primarily to let your colleagues feel that their views are being listened to and acted upon ; such half-and-half measures are to be avoided " all possible." You can do it when the issues are unimportant, but never with satisfaction or success when vital issues have to be determined.
>
> Do not hesitate for one second to be in opposition to your colleagues ; or in overriding their decisions. No business can be a permanent success unless its head be an autocrat—of course the more disguised by the silken glove the better.

There follows a caution as to the necessary balance between allowing those who have co-operated to " share to the full the Firm's glory and success " and permitting this sentiment to " boil over " to the prejudice of an undivided control. The capacity to run a great Firm is rare, and not to be confounded with the expert knowledge or skill which may make a man invaluable at his own task, and still less with the qualities by which large numbers of the so-called successful have won their way :

> A great many men are invaluable assistants who could never run a great firm. Men who can achieve success by ability and character are rare. Most of

the successful men of the day have seized success as it was passing. Their personal elements do not justify that which they have got. Circumstances, surroundings, assistants, a lucky chance have largely made them what they are.

To keep S. P. & S. making steady and sure progress requires those qualities—thoroughness, patience, courage, foresight and hard work—that I believe I have possessed and which I believe you have in abundance. Of course imagination and the vision to see where the road is likely to lead to ought to be included as an essential quality ; fair and generous dealing with all people and a due and proper sense of perspective must also not be omitted. Allow no man to substitute spurious make-believes for the real thing. It is always somewhat difficult to discriminate between the true and the false ; between the able and the merely plausible, but success demands the real thing.

Avoid rashness, impatience, greed, Keep to the methods by which we have been successful in the past. I claim that my policy has always been a conservative one. I have never ventured at one time more than we could carry if things went wrong without seriously crippling ourselves or interfering with our methods of living. This statement may seem wrong to those who judge without knowing all the facts. But it is nevertheless true. I tried to use every resource we had to the utmost extent possible. I have gone to the limit of safety time after time, but never beyond it. Knowing my trade as very few know it, I was able to accept contracts and take up ventures that it would have been madness for others to do with inferior knowledge.

What you must avoid is allowing the administration of S. P. & S. to become a strain or even a burden. The pride of being the head of one of the very first firms in the world and the joy obtained from the day-to-day successes of a great undertaking would disappear if the organization were such that his personal efforts absorbed the whole strength and time of the chief.

To carry such a burden as that of S. Pearson & Son in its most active years and not feel the strain of it, or at all events not so much as to lose pleasure in life or imperil the coolness of brain which enabled its chief " time after time to go up to the limit of safety " and yet keep within it, may well seem a counsel of perfection to other people. Whether there were moments in the great oil adventure in which this limit was passed, and retreat in good order had become precarious, if the objective had not been reached, the reader must judge for himself, but Cowdray always protested that there were not, and the sequel justified his claim.

We may the more readily accept his witness on this point because in every other part of his business the records show the enormous pains that he took to avoid anything that could be called gambling. However many tenders there might be in preparation at a given moment, he worked over each of them with his own hand, often prepared separate estimates of his own to compare with those of his colleagues, checked and verified, so far as verification was possible, down to the smallest detail. When the work was launched, he wisely left his colleagues and partners the utmost freedom in detail, but even then he watched the results with the greatest care to see that at each stage the costs were within the estimates, and if not, to discover why not. However many enterprises he might have on hand at the same time, he seemed to carry the details of each separately in his own head, and to know at every stage of each the limit of safety or the limit beyond which it would become unprofitable. This he owed largely to his unfailing habit of taking pen in hand and working his ideas out on paper. " Never trust your thoughts until you have written them down " was his constant admonition. " Only so will you discover the gaps and see what is practicable and what is not. And when you have written them once, put them by and write them again, and then compare the two writings."

He had an instinct for pricing things which to others seemed almost miraculous. He would give precise and immediate answers to almost any question that curiosity suggested: the labour cost of an embankment or cutting, the effect of a tariff or a fractional change in the exchange value of money on this or that undertaking in a foreign country, the cost of a house or cottage built in stone, brick, or cement. There is a story told of him that, passing one day through a country town, his eye fell on a collection of secondhand silver in a shop window, and that he instantly went in and offered a certain price for the whole of it. The shopkeeper said he must have time to refer to his books and price it out, but Cowdray assured him that he would find that his offer represented the cost price of the silver plus ten per cent. profit. And so, a few hours later when the books had been examined, it turned out to be, within a few shillings, immensely to the astonishment of the shopkeeper, who could scarcely be persuaded to believe that his customer had not gained secret access to his books. It was just this instinct which enabled him to undertake safely and with profit to himself operations which others thought impossible or too dangerous at the price that he quoted. He used to tell his staff " never to look over their shoulders " at a competitor in preparing a tender, but to consider simply how much a job could be done for with profit to the Firm. It was not undercutting, but a legitimate reduction of costs by care and skill which enabled him so often to put in the lowest tender and come out with profit to himself.

A tribute paid to him by Archbishop Lord Davidson, whom he saw frequently in his later years and for whom he had a deep regard may fittingly find a place in this chapter. The Archbishop writes:

> Though I had for many years heard a good deal, directly and indirectly, about his business activities and his ever-ready kindness, I had no close personal knowledge of Lord Cowdray until quite the later years of his life. During these years, however, I happened to be brought into frequent touch with him both in England and in Scotland, and I quickly came to realize the range of his knowledge, the acuteness of his observation, both of men and things, and the quiet and modest attractiveness of his personal life. I found a singular pleasure in long drives and walks with him, when he was always ready to let me draw upon his

> lucid recollections of a business experience both in England and in America which had not only been long and varied, but also full of incidents of a stirring kind. The tale of those busy years, though never thrust upon his hearers, had always to me a singular charm, due largely to the quiet straightforwardness and the perfectly simple character both of the narrator and of his story. I never shared the dislike of some people to a professional man's talk, especially in private conversation, turning constantly to the detailed recollection of incidents in which has been the business of his life. To speak contemptuously of a clever man being addicted in later years to talking " shop " seems to me a rather unintelligent blunder. In my talks with Lord Cowdray, while wholly unqualified to judge of his professional prowess, I could at least form a judgment of the man in his relation to other men, nor could one fail through the veil of his modesty to see how widely and persistently his generosity had been shown long before he had as a very rich man reached the position in which he could make his munificent gifts effective. The fact that these gifts were largely anonymous enhanced to me their graciousness and value when, somehow or other, one of them came to light.
>
> His friendship was to me of very real value, and I only wish that I had known him better in the earlier years.

To the " quiet and modest attractiveness " which the Archbishop notices as one of his chief qualities may be added his natural kindness and fairness of disposition. It is generally supposed that the Capitalist or Captain of Industry who makes a great fortune must necessarily be a hard man in his dealings with other people. The less fortunate think with a shudder of Mr. Shaw's Andrew Undershaft and his gospel. Cowdray owed not a little of his success to his known fairness and considerateness both to those whom he employed and to those with whom he did business. He was certainly a sworn foe of waste ; he wanted explanations when estimates were exceeded ; he would not have machinery lying idle or two men doing the job of one; nor would he keep an incompetent or unsuitable man who had failed after fair trial. But he was as merciful as possible on these occasions, and often paid handsomely to relieve wounded feelings. When he lost his temper or spoke harshly, he nearly always had a fit of remorse afterwards. A hasty letter is followed quickly by another retracting or softening. He is dissatisfied with an employee and tells him that he has forfeited the bonus of an extra year's salary which he had been promised on the completion of his job, and then goes away and reflects that this is hard on a man who has done good work and sends him a cheque for the bonus with a consoling letter. The dismissal of an old time-keeper from Dover Harbour at some moment when tempers were lost lingered in his memory for years, and, as recorded in a previous chapter, he put himself to great pains to have him traced and cared for in his old age. On one occasion in the most critical days in Mexico, when he had soundly rated an agent for the rising costs of his department and saw him looking dejected, he turned round with a twinkle in his eye and said, "Were you speaking in pesos or in dollars?" "In pesos," was the answer. "Well then," said Cowdray, "take back fifty per cent. of what I said." The peso at that moment was fifty per cent. of the dollar.

Cowdray knew that if he wished to get the best out of men he must encourage them and be generous in acknowledgment of past services. Who could have resented the mild hint conveyed in such a letter as this:

> 11 January, 19—
>
> MY DEAR ———
>
> I feel that your years of devoted and successful service with the Firm justify me in being extravagant by sending you a cheque for £1,500 with all my best wishes and regards.
>
> But I find we are all getting slack. I may claim that my ten or twelve years' seniority and of having to bear the heavy burden I have had entitles me to ease off. For all men under sixty, however, I can claim that their past standards should be merely an

> indication of the improved ones of the future. Hence I can look forward, with every confidence, to participating with you in the joys you will have from redoubled efforts and corresponding successes.

His business communications with the men who were serving him, especially when they are abroad, have always a friendly touch. He inquires after their health and their wives and children, if these are with them ; and if they fall ill, he is ready with sympathy and offers of help going far beyond what was obligatory in an employer in such circumstances. Every business connexion with him tended to become a friendly personal relationship ; and whether in the office in London or on the oil-fields in Mexico he was " the Chief " to whom the leadership was conceded with unstinting loyalty and affection. He knew the foremen on his various contracts individually, and it was his genial and kindly relations with them which made so many of them follow the Firm from job to job.

But, above all, he and his Firm owed their success to straightforward dealing and good workmanship. If he forged ahead in the early days, it was because it became known that he could be relied upon to give the best and to abide by his contract, even though it went against him. If he gained a unique position in Mexico, it was again because the Mexicans trusted him to act with the same fairness to them as he acted to his English or American employers. Pearson, as President Diaz quickly discovered, was incapable of the tricks which a mere exploiter is apt to play on new or backward countries. He would not charge extravagant prices, seek to amend his contracts when unexpected difficulties arose, wind up and depart, leaving his work unfinished, when he had taken the plums out of a contract. He would even, when the Government was in difficulties, accept its promises to pay, or provide capital of his own for enterprises which it was unwilling to finance. The large part which goodwill and mutual confidence played in some of these transactions and the risks which Cowdray took in simple reliance on his reading of the character of the men he was dealing with would be astonishing to those who believe that successful business depends on the observance of strict business principles. Throughout his life Cowdray acted on the assumption that, if he dealt fairly with other people, they would deal fairly with him, and in his belief it was worth more than any possible legal guarantee.

It was this essential simplicity of character and largeness of outlook in combination with an extraordinary capacity for detail which made him unique among the business men of his time. Other men had the one capacity or the other, but hardly any other combined the two to the same degree. He knew every tree in his wood and yet never lost sight of the wood because of the trees, or was so immersed in the business of the present as to be without a policy for the future. He had the constructive engineering kind of mind which could never rest in the thing accomplished but always raced forward into the future. Undoubtedly he made a great fortune for himself, but by activities which increased the general wealth, and his story is an example of what may be contributed to that end by the courage and enterprise of one man of commanding ability.

APPENDIX I

LIST OF CONTRACTS CARRIED OUT BY S. PEARSON & SON LIMITED.

Name of Contract.	Date.	Amount.	For.
		£	
Dewsbury, Heckmondwyke and Batley Waterworks	1854	—	—
Lancashire and Yorkshire Railway—various works	1857–77	—	Lancashire and Yorkshire Railway Co.
Uppingham Sewerage	1858	—	—
Staincliffe Reservoir	1858	—	—
Doncaster—Catherine Street and Hyde Park Sewer	—	—	Doncaster Corporation
Skipton Sewerage and Waterworks	1859–60	—	Skipton Board of Health
Work for Bowling Ironworks	1863	—	
Great Northern Railway—New Works and maintenance, Mirfield and Stanningley Stations	1864–67	—	Great Northern Railway Co.
Ripley Reservoir	1865	—	—
Leeds, Bradford and Halifax Junction Railway	1865	—	—
Bradford Waterworks—The Oxenhope Tunnel	1870	15,000	Bradford Corporation
Doncaster Main Sewer Extension	1871	—	Doncaster Corporation
Horton Park Bottom Storage Reservoir	1871	—	W. Ramsden and Son
Dudley Hill Drainage	1874	—	—
Southport Main Drainage	1876–78	70,000	Southport Corporation
Ipswich Main Drainage	1879	60,000	Ipswich Urban Sanitary Authority
King's Lynn Dock	1879–84	105,000	King's Lynn Docks and Railway Co.
Deptford Storm Water Sewer	1882	34,000	Metropolitan Board of Works
Sheffield Main Sewerage	1884–87	144,000	Sheffield Corporation

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Name of Contract.	Date.	Amount. £	For.
Milford Haven Docks	1885–90	120,000	Milford Docks Co.
Halifax (Nova Scotia) Dry Dock	1886	270,000	Halifax Graving Dock Co. Ltd.
Southampton—Empress Dock	1886–91	210,000	Southampton Dock Co.
Portsea Torpedo Range	1887	30,000	British Government
Avila and Salamanca Railway, Spain	1888–90	950,000	Madrid and Portugal Direct Railway Ltd.
Mexico—Grand Canal	1889–98	2,000,000	Mexican Government
Hudson River Tunnel, New York	1889–95	235,000	Hudson Tunnel Co.
Alexandria — Dredging Entrance Channel	1889–94	83,000	Egyptian Government
Great Western Railway Widening between Plympton and Brent	1890–94	150,000	Great Western Railway Co.
Portland Coaling Camber and Pier	1890–92	8,400	British Government
Blackwall Tunnel	1891–97	870,000	London County Council
Lancashire, Derbyshire and East Coast Railway (3 sections)	1892–97	1,035,000	Lancashire, Derbyshire and East Coast Railway Co.
Bermuda Dredging	1893–96	50,000	British Government
Surrey Commercial Dock Extension—1895 Contract	1895–98	164,000	Surrey Commercial Dock Co.
Cardiff Channel Graving Dock	1895–98	100,000	Cardiff Channel Dry Docks and Pontoon Co.
Vera Cruz Harbour Works	1895–02	3,000,000	Mexican Government
Port Talbot Railway and Dock	1895–1900	720,000	Port Talbot Railway and Dock Co.
Juile Railway, Mexico	1896–1900	100,000	Vera Cruz (Mexico) Railways Ltd.
Lambourne Valley Light Railway	1896–98	125,000	Lambourne Valley Light Railway Co.
Coatzacoalcos Port Works — Dredging, Breakwaters, Wharves, Sheds, etc.	1896–09	1,400,000	Mexican Government
Leith Dredging	1896	40,000	Leith Harbour and Docks Commissioners
Devonport Slipway	1897	13,000	British Government
Tehuantepec National Railway	1898–06	2,500,000	Mexican Government
Bristol and South Wales Direct Railway	1898–04	1,300,000	Great Western Railway Co.
Great Northern and City Railway	1898–06	2,457,000	Great Northern and City Railway Co.

Name of Contract.	Date.	Amount. £	For.
Dover—Admiralty Harbour	1898–09	3,365,000	British Government
Surrey Commercial Dock Extension—1898 Contract	1898–06	470,000	Surrey Commercial Dock Co.
Seaham Harbour and Dock	1899–07	378,000	Seaham Harbour Dock Co.
Salina Cruz Harbour and Docks	1899–07	3,300,000	Mexican Government
New Ross and Waterford Railway	1899–03	150,000	Dublin and South Eastern Railway Co.
Dublin Main Drainage Outfall	1899–05	120,000	Dublin Corporation
Banbury and Lockwood Reservoirs	1899–04	338,000	East London Waterworks Co.
Alvarado Railway Reconstruction	1900	100,000	Vera Cruz (Mexico) Railways Ltd.
Malta Dry Docks	1901–06	625,000	British Government
Vera Cruz Drainage and Water Supply	1901–03	400,000	Vera Cruz State Government
Waterford Joint Lines	1902–03	15,000	Waterford Joint Lines Committee
Netherton Colliery Sidings	1902	7,000	Netherton Dale Coal Co.
Taokou to Ching Hua Railway	1902–06	500,000	Pekin Syndicate Ltd.
Liverpool—Queen's Branch Dock	1902–05	340,000	Mersey Docks and Harbour Board
Finsbury Park Underground Station	1902–04	101,000	Great Northern Railway Co.
Malta Breakwaters	1903–09	500,000	British Government
Plymouth Main Sewer Outfall	1903–06	28,000	Plymouth Corporation
Dover—Prince of Wales' Pier Railway, Landing Stage and Swing Bridge	1904	24,000	Dover Harbour Board
New York—East River Tunnels	1904–09	3,500,000	Pennsylvania, New York and Long Island Railroad Co.
Salina Cruz Drainage and Water Supply Coatzacoalcos Drainage and Water Supply	1905–07	385,000	Mexican Government
Catford to Plumstead Main Outfall Sewer	1905–08	450,000	London County Council
Punta Arenas Drainage and Water Supply (Chile)	1905–08	65,000	Punta Arenas Corporation
Dorado Railway Extension (Colombia)	1905–08	250,000	Dorado Extension Railway Ltd.
Pará Port Works (Brazil)	1906–11	2,100,000	Pará Construction Co. Ltd.
Hull Joint Dock	1906–16	1,334,000	Hull Joint Dock Committee
Minatitlan Railway (Mexico)	1906	15,000	Compañia Mexicana de Petroleo "El Aguila" S.A.
Mazatlan Drainage	1906–08	60,000	Mexican Government

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Name of Contract.	Date.	Amount. £	For.
Dover—Admiralty Pier Widening	1909–14	350,000	Dover Harbour Board
River Conchos Water Power and Irrigation (Mexico)	1909	850,000	Mexican Northern Power Co.
Erie Barge Canal—Contract 20 B.	1909–15	192,000	State of New York
Vera Cruz Terminal	1909–11	220,000	Vera Cruz Terminal Co. Ltd.
Barrow and Barton—Oil Tank Installations	1910	2,100	Producers' Petroleum Co. Ltd.
Holyhead Breakwater Improvements	1911–15	33,000	Board of Trade
Dover—Foundations for Maritime Station	1911–13	50,000	South Eastern and Chatham Railway Co.
Bayonne Salt Water Intake	1911	10,600	Babcock and Wilcox Ltd.
Royal Albert Dock Extension (South)	1912–18	1,398,000	Port of London Authority
Valparaiso Port Works	1912–24	2,710,000	Chilian Government
White Plains Avenue, Castle Hill and Westchester Sewers	1912–13	65,000	City of New York
Larega Avenue and Ludlow Avenue — Regulating and Grading	1912–13	12,500	City of New York
Fort Plain Water Main	1913	2,400	Trustees of the Village of Fort Plain, New York
H. M. Factory, Gretna	1915–18	9,184,000	British Government
Dover—Defence against Submarines	1915	—	British Government
Wallett—Defence against Submarines	1915	—	British Government
Forts at Sunk Island and Stallingborough on the Humber	1915	—	British Government
Chateauroux—Tank Factory (France)	1918	—	Anglo-American Commission
Dover—Langdon Battery	1919	3,300	British Government
Hodbarrow Mine—Works for Protection against Flooding	1919–20	24,800	Hodbarrow Mining Co. Ltd.
Littleton Reservoir	1919–24	1,514,000	Metropolitan Water Board
Seaham Dock Gates Seaham Cliff Protection	1919–21 1920	84,000	Seaham Harbour Dock Co.
Stanlow Oil Dock	1919–23	115,000	Manchester Ship Canal Co.
Brussels Drainage Galerie	1920–21	6,100	Belgian State Railways
Demerara Bank	1920–22	34,000	Colonial Bank Co. Ltd.
Dawdon Colliery Coal Depot Seaham Harbour Coal Depot	1921	5,400	Londonderry Collieries Ltd.
Dover Harbour Dredging	1921–22	33,000	Dover Harbour Board

Name of Contract.	Date.	Amount. £	For.
Charlton Storm Relief Sewer	1922–24	128,000	London County Council
Sennar Dam and Gezira Irrigation	1922–25	3,864,000	Sudan Government
Dover—Limekiln Street Bridge	1922–23	12,500	Dover Corporation
Betteshanger Siding and Colliery Buildings, etc.	1922–25	140,000	Pearson and Dorman Long Ltd.
Silent Valley Reservoir	1923– (under construction)	983,000	Belfast Water Commissioners
Junin Jetty (Chile)	1923–24	14,000	Whitehall Trust Ltd.
Valparaiso Breakwater Extension	1923– (under construction)	1,470,000	Chilian Government
Snowdown Colliery Buildings, etc.	1924–26	66,000	Pearson and Dorman Long Ltd.
St. Clement's Wharf, etc.	1925	21,500	Thames Land Co. Ltd.
Puerto Bories Mole	1926	31,000	Sociedad Explotadora de Tierra del Fuego

APPENDIX II

Rectorial Address delivered to the Students of Aberdeen University, 22nd October, 1920.

LABOUR: ITS PROBLEMS AND THE IDEAL WAGE

I AM proud to meet my constituents to-day in such strength and in such a magnificent hall. It is a pleasure that has been deferred, perhaps unduly, but the delay has in no way impaired my appreciation of the honour you conferred upon me when I was elected your Rector. I value that position most highly, and am most truly indebted to you for such a mark of your favour. Having regard to the prevailing upheaval of labour, not only in this country, but generally throughout the world, I have selected for my subject that of "Labour: its Problems and the Ideal Wage," a subject that I venture to hope will not be considered as being inopportune.

It is also a subject on which I ought to be able to speak with knowledge, and that largely based on the experience I have gained in my own business. I may say I have been a day-by-day worker for almost fifty years, years spent in sustained effort in trying to live up to my motto—"Do it with thy might"—in fighting the battle for success against the forces of nature, in creating and controlling many varied and huge undertakings and enterprises, and always in competition with the world. My endeavours have been successful, because I definitely fixed, from time to time, very often years ahead, the goals I was striving for, and perhaps more so, because I have always enjoyed the loyal, devoted, and determined support of my partners, my staff, and of my co-workers, from the highest to the lowest. My experience in working with, and amongst, many tens of thousands of men has made me conversant with their needs and their ambitions, and my business knowledge tells me what can be done and what cannot be done, having regard to the general welfare. Whether or not I view labour and its problems with fairness and practicability, you can judge when I have finished. If I fail, it will not be because I have not tried to be as judicial and as sympathetic as existing world conditions permit. And now for my discourse.

The remuneration of labour may be taken either in the broad sense which raises the whole question of the methods of production and division of the product between different members of the community, or in the narrow sense which confines it to amendments or modifications of the existing wage-system. It is hardly possible to consider the one without the other, for either takes us eventually to the fundamentals—the different possible types of social organization for the production and distribution of wealth, communistic, socialistic, individualistic, capitalistic, etc. Here the difficulty is that men are nowhere writing on a clean slate. They all, in modern times, have to start with a conception of wealth or property which is the growth of hundreds, even thousands, of years of gradually evolving tradition and custom, and which is an integral part of the structure of society as we know it.

When we are talking of dividing wealth, or apportioning the shares of wealth, the nature of the wealth we are thinking of must be defined. Property, as we know it, consists not merely of things tangible and material—such as land, houses, factories, minerals, shipping, etc.—but of an immense variety of claims, such as goodwill, credits, anticipations of the future, estimates, hopes, and even fancies of what may be produced, which can be discounted and assessed at present values. A great part of these are mental and psychological, and all of them are bound up with the assumption that the present state of society will continue, and would perish if it perished. The wealth of the United Kingdom is frequently assessed at 24,000 millions, and it is said that, if it were divided up equally between the inhabitants, there would be £500 for every man, woman, and child. But the division is a total impossibility. The assumed wealth could not be realized in present values, and, if it could be, it would be largely destroyed in the process of dividing it, for it is all based on the capitalist system, which the division would extinguish. The idea of rewarding the proletariat by dividing the spoil is, therefore, not so much wicked as it is illusory.

This the Bolsheviks have discovered in their attempt to apply communism to Russia. When they destroyed the capitalistic system, that is to say accumulated wealth used in producing more, they inevitably also destroyed the values which it had created, and there was nothing to divide except what, so to speak, society stood on or stood up in, its lands and its houses, its clothes, its jewels and hard money, and the stock of eatables and drinkables which it had accumulated to carry it along for a few weeks or months. You may destroy capital, but you cannot at the same time exact a huge indemnity from it. This does not apply to what we call real property. You can divide land, and in a country where agriculture is primitive carry on without much disturbance of the ordinary life, except to the landowners who are dispossessed. Thus the peasantry of Russia suffer comparatively little from the Russian upheaval. But the town workers are thrown into confusion and starvation, since there is no wealth to compensate them for the disorganization and paralysis of industry caused by the destruction of the system which has controlled and directed it.

Another system *may* be built up in time, but if so, and if it succeeds, it will not be because it has confiscated and divided the old wealth, but because it has discovered a way of producing new wealth. For this reason the idea that the proletariat can be benefited or the worker remunerated by the division of existing wealth must be dismissed as a veritable " will o' the wisp." If we are to make a new world on Communist lines, we must begin by writing off the values of the old world.

A great many Socialists realize this, and therefore what they propose is not the destruction of the present order, but the transfer of its control from the individual to the State. In most of the systems which they propose the capitalist system is to remain, subject to certain improvements which they think they can introduce into it, but the capitalist in future is to be the State and not the private individual working for his own profit. They constantly talk as if the worker would necessarily earn a better wage, have more security, and better conditions if he were working for the State than if he were working for a private employer.

I need only say that this claim is an unproven assumption. It assumes that the total product will be increased if private profit is extinguished, and that the creators, controllers, and directors of industry and commerce, the inventors and designers, will do better work for the State, though receiving a less remuneration, than they now do for themselves. This is an assumption which no impartial person thinks of making in regard to the manual labourer, and there is no obvious reason why it should be true of other kinds of workers.

It is sometimes said that because certain great industries were temporarily nationalized or socialized in time of war, and worked with considerable efficiency, the same can be done in time of peace. As a condition of efficient Socialism it would be necessary to educate the civic motive to the point at which men will work with equal or greater zeal for the State than for themselves. One need not be so cynical as to say that human nature is totally incapable of this, but at least it must be a gradual process of evolution and not a sudden change or conversion imposed by law. In the actual socialistic experiments we have seen, there has invariably followed disorganization and decline of efficiency and of output. Then the State, compelled to keep up nominal wages with declining outputs and uneconomical production, is driven to fill the gap by printing paper money—the almost invariable recourse of revolutionary Governments.

But even if we suppose these obstacles overcome, none of the socialistic schemes which are presented to us attempt to solve the problem of the remuneration of labour. The transfer of the controlling and directing functions from one set of individuals called employers and capitalists to another set of individuals called the State leaves the question of the division of the product untouched. The wage-earners hold tenaciously to the position that they will not forgo their right to strike, whether the State is controller or the private employer, and frequently reject moderate and most reasonable proposals for delay and arbitration. The present strike of the miners is a glaring example. So under the one system as under the other we are still faced with the problem of the just distribution of the product and the possibility of great strikes to decide it.

The Communists have the solution of forced labour, prohibition of strikes, and fixed legal remuneration decided, without appeal, by Government. But the Socialists and nationalizers reject these solutions and do not tell us how the division is to be effected, except by the present method of collective bargaining, with strikes as the last word. Yet no one can be satisfied with that solution. It has all the defects in the industrial world of war and war-like methods in the political world. It ranges workmen and employers in hostile camps—though their aims must be identical—it leads to a sharp diplomacy in which the two sides are under a perpetual temptation to outwit each other, and not infrequently to ruinous conflicts, the cost of which to the trades concerned, and to the whole community, is out of all proportion to the questions in dispute and far greater than any advantage that either side can gain, even if it is completely victorious.

Since none of the political systems, whether socialistic or individualistic, now in debate appears to offer us any relief from this, would it not be well, for the time being at all events, to leave these debates on one side and attempt to discover what are the elements of a just distribution of the joint product of hands and brains, or what at least is expedient and politic as between man and man ?

Here our hope lies in substituting the idea of partnership for the idea of war. This may be very difficult to achieve, but it is none the less the idea to bear in mind, and the ideal to aim at.

But the partnership unfortunately never can be on equal terms. Men are not equal either in hands or brains. One man works quicker than another, is handier than another ; another has a genius for organizing and inventing not shared by his fellow-men.

A former generation was content that the devil should take the hindmost and consoled itself with the thought that the hindmost deserved his fate. The present generation has got beyond that and judges that it is both inhuman and impolitic that any considerable number of the community should be hopeless and derelict.

So we advance to the principle of the minimum wage, which endeavours to secure that no employed man or woman shall receive less than will enable him or her to maintain a relatively decent standard of existence. A minimum wage should necessarily carry with it the demand for a fair day's work in return.

We are also groping our way to some kind of unemployment insurance which will prevent him or her from being plunged into complete poverty by the fluctuation of the labour market. When we are considering the remuneration of the worker, we have always to bear both problems in mind. For it would be little use to invent an ideal wage, if for any considerable part of his time the worker had no opportunity of earning it.

Still for the moment we may take these problems separately, and ask what are the factors in the " ideal wage," if I may so speak of it. I think they are three. First, the guaranteed minimum of which I have just spoken ; second, a variable quantity according to the output of the individual ; third, a variable addition according to the result of the undertaking—to put it shortly, *piecework with a guaranteed minimum and a bonus on profits.*

This, if realized, would secure the worker against falling below the poverty-line, put a premium on his individual effort, and give him an interest in the results of his labour. It would follow logically from the last condition that he should, like other interested persons, have some voice in the management of the concern and the distribution of its profits. And this would be the great steadying factor. It should enlist him in the side of just and peaceful settlements and the avoidance of strife which would be plainly injurious to the industry.

The first factor, the guaranteed minimum wage, is now generally recognized and operative. The second factor, piecework—the payment by results—is realized over a wide field and is the accepted method in many industries.

But some of the Trade Unions are active in their endeavours to kill all piecework. This they cannot be allowed to do. In my opinion, without piecework few industries in this country can permanently flourish. One of the happinesses of life is the contentment arising from good work well done. This happiness is not so universal, unfortunately, as it should be. Those who indulge in " ca' canny " must be entire strangers to it, and while we must utterly condemn and deplore their conduct, we cannot withhold our sympathy towards them on this loss.

We are only at the beginning of the third factor, the bonus on profits, and it presents considerable difficulties. The worker is generally not in a position to engage in the business as an ordinary shareholder. He cannot embark other capital than his own labour or run the risk of loss.

There have been many ingenious schemes for partnership, or as it is sometimes called, co-partnership, in industry. They range from experiments, which are partly successful, but cover a very small field, up to the big designs of what is called Guild-Socialism. This proposes, so far as I understand it, that each particular industry or workshop—the schemes vary in detail—shall be carried on by the craftsmen engaged in it for the benefit of the craftsmen and none others, whether the State or the Capitalist. To upheave all industry on the chance that one or other of these schemes would be successful would almost certainly be to court the results that we see in Bolshevik Russia. But there is no reason at all why experiments of this kind should not be made on a moderate scale. The workmen in these days have command of a large amount of capital. Comparatively small levies would suffice to produce the amount needed to start workshops on these principles.

The Co-operative Wholesale Society has immense funds at its disposal, all of it workmen's money, and it might apply at least a part of them in fruitful and useful experiments in co-operative production of the foods and goods needed for its own stores, instead of relying almost wholly, as it does now, on ordinary capitalist methods. In these days when theories abound, and so many that have never been verified in practice, are advanced by workmen, or those who speak for them, as panaceas for existing evils, I think it is reasonable to ask that they should use some of their own brains and money in showing that these theories are practicable. It is a mistake to suppose that the difficulties will be overcome, as some of these theorists appear to assume, by the simple expedient of giving the name " craftsmen " to all persons engaged in a particular industry, and concluding that a just division between the various classes—organizers, designers, inventors, mechanics and labourers—which must co-operate will thereby be automatically discovered.

Notwithstanding the many and difficult problems involved, I believe it is imperative, in the best interests of the country, its workers and its trade, that co-partnership should exist. I therefore submit to both employers and employed that in the position we have reached it is all-important to make great efforts to develop this third factor, the bonus on results, with its corollary, the workman's voice in management.

I will mention, but not attempt to solve, some of the points that will arise in any co-partnership scheme : (*a*) The return that capital should receive for its use and the risk it runs. (*b*) The remuneration to be paid for brains, experience, and for special and exceptional services. (*c*) After providing for the foregoing how should the surplus, if any, be apportioned between the capital employed, the administration or management, and the workmen ? The proper division of this surplus must necessarily vary with each trade. It should be divided so that each receives according to its contribution to the making of the surplus. (*d*) Provision should be made as to the providing of the additional capital that will be required from time to time. In the past most businesses have been built up, or largely so, out of their profits, the soundest and best of all methods. (*e*) How are the workmen's representatives who are to assist the administration to be appointed ? They must be satisfactory to both masters and men. I assume they must be old employees of the firm, and that their tenure of office must be for not less than two or three years. (*f*) How could the workmen's part in the administration of the business be determined or defined ? In the early years it must be limited to advice, principally upon the details of operation and administration, and to seeing that the agreed-upon proportion of the surplus accruing to the workers is duly set forth. With experience and development, co-partnership would show to what extent and how the workers' responsibilities might be increased.

It is the right solution of these points, the finding out of the way to the partnership and mutual understanding, which will alone bring peace and prevent the struggle for the division of the profits of industry being a blind tussle of forces.

But even if we suppose the wage question to be settled, there remains the question of unemployment, which is one of the chief if not *the* chief cause of Labour unrest. It is the lack of security, the fear that he may any day lose his job, which, more than anything else, leads the workman to question the existing social system. He has an idea that he will be secure if the State is his employer, and that the State will be obliged to take care that he is not suddenly deprived of his livelihood by the whim or arbitrary decree of an individual or by the fluctuations of supply and demand.

It is exactly the same feeling that sends large numbers of middle-class men to seek employment as civil servants. They believe that in the public service they are, at all events, safe from the changes and chances of the ordinary professional or business life. No one, as some of them discover, is safe, and it is almost certain that the security would diminish in proportion as the State extended its responsibilities. But the feeling is natural, and beyond all doubt the insecurity of large numbers of the working class is a very great evil and far in excess, in my opinion, of what it need be. At any given moment the number of employable, but unemployed, persons is a very small proportion of the total. For the organized trades the figure seldom exceeds 6 or 7 per cent. even in the greatly depressed times.

But a very little slackness in demand may throw a large number of men into a state of half-employment, which quickly reduces them below the poverty-line, and inflicts great anxiety on others lest they should be brought into the same position or entirely thrown out of their job.

Trade-unionism cannot prevent men from being discharged or works shut down, and the remedy it seeks is the most dangerous and ruinous one of trying to get the largest amount of employment out of a given quantity of work, in the fear that there may not otherwise be enough work to go round.

This " ca' canny " policy lowers production and increases costs, with the inevitable result that demand is checked, and the total of employment diminishes, though, in one trade or in one area, it may be artificially maintained. Many remonstrances are being addressed to the working classes, in these times, on the subject of output, but mere lectures which do not realize their point of view are likely to be futile.

Until we seriously sit down to the question of unemployment and attempt to give to the working-class life the security which it now lacks, these quack and extremely disastrous remedies will continue to be applied, and the economists will remonstrate in vain.

Partly it is a question of organization. By pooling the resources which an industry needs to meet times of exceptional pressure, the number of casuals who are taken on when work is brisk, and discharged when it falls off, can be reduced to a minimum. For example, a great dock trust, which applies itself to this question, and mobilizes its labour quickly from the points where work is slack to the points where it is brisk, can do with a far smaller reserve of casuals than a number of separate employers who each keep a reserve of casuals for moments of exceptional pressure. And if employers generally can be brought to feel a greater responsibility for maintaining continuous employment, similar measures in other trades may greatly abate the evil. But when all these measures have been taken there will undoubtedly, in any time that we can foresee, remain a residuum who will be half or wholly unemployed in bad times.

The Government is endeavouring to solve this problem by a measure which combines all trades in a single scheme, and invokes the aid of Friendly and Insurance societies, as well as trade unions, in a common insurance.

The trade unions, on the other hand, maintain that each trade should be made responsible for its own unemployed, and the insurance effected between the unions and the employers with Government aid but without the intervention of Friendly and Insurance Societies. The objection to this is that the heaviest burden might fall on the trades least able to bear it, while the wealthy trades, with their small number of unemployed, made little or no contribution.

The subject, in my opinion, needs careful examination and trial; and so far we have only broken first ground. There are, of course, difficulties, but the amount of unemployment ought to be relatively so small that the financial problem of insuring against it ought not to be very formidable, and the psychological results of so doing would certainly be of the utmost importance.

To sum up, we have fallen into the habit of thinking and speaking as if the wages problem, the problem of the remuneration of the worker, were bound up with the revolutionary changes in the structure of society, the overthrow of capitalism, the establishment of Socialism, Communism, Syndicalism in its place. That is not really so. For these new forms of society, even if successfully established, would be faced with essentially the same difficulties as face us now in distributing the products of hands and brains justly between men and women of differing capacities.

If we reject the Bolshevist solution of forced labour and distribution, at the fiat of a small number of dictators, who suppress all protests, the controversy is merely transferred from one pair of disputants to another pair of disputants, from workmen and employers to workmen and the State, or the public. So whether we are individualists or socialists or communists or capitalists, we have to tackle this problem on its merits, and endeavour to solve it as a human problem raising elementary questions of justice and fairness between man and man.

No one can think the present solution satisfactory or final, and, since those who are called capitalists are in possession, it is for them especially to exert themselves to find remedies for evils which, however unfairly, will be laid at their doors. I suggest that if we could make the principles of what I have called the " ideal wage " our aim, and endeavour to adjust our machinery accordingly, and at the same time address ourselves seriously to the problem of unemployment, we should go a long way to compose strife and to open the road to the mutual partnership and co-operation which will alone make industry efficient, and increase the total wealth in the measure in which it can and should be increased. My own opinion is that if these problems were solved, or even appreciable progress made in their solution, it would become evident that the greatest advantage lay in leaving the widest liberty to individual endeavour, enterprise, and adventure. But even if I were wrong, a mutual effort to find their solution, in which Labour and Capital, and men of all shades of thought, honestly took part, could not at all prejudice the contrary opinions.

I have to thank the members of the University for the very patient hearing they have given to me. Those who have not been able to hear will, I hope, take the opportunity of carefully studying what I have said. I have given great thought to the problem, and I believe the solution to the present grave labour unrest lies largely along the lines that I have suggested.

APPENDIX III

Reply prepared by Lord Cowdray before his death to the speech which the Lord Provost had intended to deliver in presenting the Freedom of Aberdeen. The presentation was to have taken place on May 3, 1927, *two days after Lord Cowdray's death, and his reply was printed in the Aberdeen Press on the morning of May* 3.

My Lord Provost, Magistrates and Council,

I am sadly conscious that by this time the audience must have heard enough about us, but as you have roused old and pleasant memories, I will, if I may, without abusing your hospitality, say a few words which I hope you will find not uninteresting. The only excuse for such egoism is that I really believe there is for those who come after us some interest, and possibly even some help, in knowing what were the formative influences which touched the lives of their elders to useful purpose.

In my own case I must put in the very forefront the creation on the banks of the lovely River Aire in Yorkshire the village called by its founder, Sir Titus Salt, Saltaire. So long ago as 1850, he conceived and carried out this perfect model of a small township, with its factories, institutes, schools, almshouses, libraries, and housing amenities which have served as examples for over seventy years of what such things should be.

It is more than forty years since I saw Saltaire, but I know that deep into my mind sank then a conviction of the tremendous importance of such things, and that to beautify one's surroundings, to introduce order and method and cleanliness where such things are not became to me an end in themselves, apart from the joy of creating them, or from the pleasure and happiness the public derives from their existence.

Next in order I should place a journey to America which I undertook as a youth of nineteen, after having already served three years of strenuous apprenticeship in my own Firm. It may be interesting to recall that I crossed in a White Star liner, the crack boat of the time, a 5,000 tonner making 16 knots. It had sails in addition to steam. Since then passenger ships have grown tenfold in tonnage and fifty per cent. in speed. On arrival in New York I found that my £5 notes commanded 17 per cent. premium, that the banks allowed 6 per cent. on deposit, and that mortgages on first-class property returned 10 per cent.

I saw the principal towns in Canada and the United States east of the Mississippi—west of the river counted for little in those days. I was in Chicago three years after the great fire and stayed in its much advertised fire-proof hotel. Then from St. Louis down the Mississippi to New Orleans by boat, a trip which took ten days, and through the slave country within ten years of the termination of the Civil War. I saw the negro revelling in his new freedom, but with many of the difficulties between him and the white man still to adjust. In Washington I saw General Grant, who had then become the President. These were all experiences vastly interesting to an unsophisticated youth of nineteen.

I returned home with an intense admiration for the Americans. I marvelled at their progress during a short 100 years of existence as a nation. Some of their methods of work were instructive, their energy and ambition infectious. I returned to England seeing no reason why the great things being done in America could not be done elsewhere. When I say that I had taken the Americans at their own valuation you will realize how hugely I had been impressed by them.

Yet, within a few years, I had the real joy of contracting, on behalf of my Firm, with an American company, for the completion of the tunnel under the River Hudson between New Jersey and New York. The construction was only possible by the English invention of the Greathead shield system. Sir Benjamin Baker, the engineer for the Forth Bridge, was appointed engineer.

If, however, you will allow me to focus still more of your attention on the influences which have shaped my life, to which to-day your own splendid tribute seems for once to lend some unusual interest and importance, I cannot refrain from saying that nothing comes into the same category with the great crowning influence which a man possesses in that perfect partner, a well-mated wife. To have by you one who shares with head and heart the successes and the failures, who gives due encouragement, but has the courage to administer the home-truth, unpalatable but necessary sometimes, who is never afraid of responsibility, prepared to start life afresh should need arise, such a partner is beyond praise or price. She is simply one's needed life-blood, and I make no apology, my Lord Provost, for this due tribute to mine.

Indeed, in all my partners I have been singularly blessed. I wish I had time to enumerate them all, singly and in combination. Experts in their various ways, they have been at one in their single-hearted devotion to the Firm's best interests, and my work would have been impossible without their co-operation. They joined me as young men, and if growing old can ever be a pleasure it has been in growing old together. On this great day in my life, and from this platform, I wish to thank them.

And now, my Lord Provost, having taken up the limit of this distinguished audience, by far too many references to a life in no way different, thank God, from that of my average fellow-man, except perhaps by its good luck in having chosen at its outset work of absorbing delight, I would like, even at the risk of closing my remarks by well-worn platitudes, to say just one thing to the young men and women who must carry on the work of the world.

In no part of it, and I have worked in many, is there any short cut or royal road to success, and success includes much more than mere money-getting. I say this because I am so often asked by anxious parents how they can ensure the success of their children—as if there were a secret to divulge.

Nobody can ensure the success of another—a man must stand on his own feet. The inexorable law is character, and let every young man ambitious to succeed feel he has lost his way until he finds a job which absorbs all the best of himself. Success is sweet—to-day truly I realize how profoundly sweet—but the joy is in the doing; not the end of the journey, but the travelling is what makes life worth while. My Lord Provost, I thank you again deeply. What I have been able to say to-day falls so far short of what I feel on this never-to-be-forgotten occasion.

In the course of her reply Lady Cowdray said :—

From our joint start in life, it seems to me that we two, your youngest burgesses, settled almost without knowing it, two of the burning questions which to-day are still agitating many minds. I am almost afraid to mention here such possibly controversial topics, but I expect you will guess them for yourselves. The first, "Is Woman's place necessarily limited to the Home?"; the second, "Should married women Work?"

I shall eternally be thankful that life gave me a partner who answered both these questions in my own spirit. To that Freedom, my Lord Provost, I owe to-day's Freedom, if in any sense at all I have any claim to deserve it at your hands.

APPENDIX IV

PICTURES AT DUNECHT.

Title.	*Painter.*
Sir Walter Scott	Sir J. Watson Gordon P.R.S.A
Anne, Countess of Ormonde and child	Sir Joshua Reynolds, P.R.A
John, 2nd Earl of Donoughmore	Sir Joshua Reynolds, P.R.A
Lord Aberdeen	Sir Thomas Lawrence, P.R.A
General Mackenzie Fraser	Sir Henry Raeburn, R.A
Portrait Group	John Hoppner, R.A
Studio of the Painter	Sir John Lavery, R.A

And a Gallery of 18 important examples of the work of James Pryde.

Amongst other living English Painters represented are Augustus John, R.A., William Nicholson, Professor William Rothenstein, Charles Ricketts, R.A.

PICTURES AT CARLTON HOUSE TERRACE.

The Morning Room contains six very fine examples of the work of William Nicholson.

Title.	*Painter.*
Mrs. Stewart Marjoribanks	John Hoppner, R.A
Mr. Stewart Marjoribanks	John Hoppner, R.A
William Pitt the Younger	John Hoppner, R.A
The Archer, Lord Morton	John Hoppner, R.A
Mrs. King of Duniva and Mr. King	Sir Henry Raeburn, R.A
Alexander, 10th Duke of Hamilton	Sir Henry Raeburn, R.A
Viscountess Pollington and child, afterwards Lady Mexborough	Sir Thomas Lawrence, P.R.A
Earl of Eldon	Sir Thomas Lawrence, P.R.A
Georgiana, Lady Gordon, afterwards Duchess of Bedford	Sir Thomas Lawrence, P.R.A
Lady Saye and Sele and her brother, Col. William Eardley	Sir Joshua Reynolds, P.R.A
Miss Gresley	Sir Joshua Reynolds, P.R.A
Mrs. Villebois	Thomas Gainsborough, R.A
Mrs. Huth	James McNeill Whistler

Pictures by Continental Artists.

Title.	*Painter.*
Admiral Tromp	Rembrandt Van Ryn
Queen Henrietta Maria	Sir Anthony Van Dyck
François Langlois, called Ciatres	Sir Anthony Van Dyck
Joseph Coymans, Lord of Bouchen and Nieuwall	Franz Hals
Don Gaspara de Guzman, Count Duke of Olivarez	Velasquez

Family Portraits by Sir William Orpen, R.A., John Sargent, R.A., and William Nicholson.

Pictures at Paddockhurst.

Title.	*Painter.*
Mrs. Mair, née Thompson of Plantation, near Glasgow	Sir Henry Raeburn, R.A
Marquess de Leganez	Sir Anthony Van Dyck
Madame Kirk	Sir Anthony Van Dyck
Lady Hamilton	George Romney
Hon. Charles Francis Greville	George Romney
Lady Isabella Hamilton	George Romney
Self Portrait	John Hoppner, R.A

Greek Statuary from Hope Collection.

Statue of Athene. Life (Pheidias)
Greek Woman about 500-460 B.C.
Emperor Augustus
Nero
Empress Faustina the Elder
Lucius Verus
Septimus Severus

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